73 AMATEUR RADIO
Our 200th Issue!

73
SEP.61
AMATEUR RADIO
SPECIAL VHF ISSUE
A HAM IN THE WHITE HOUSE ?
ANNUAL NOVEMBER ISSUE
25 Feature Articles
RECEIVERS
SPECIAL SURPLUS CATALOG
UFO
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TM-73
RADIO SURPLUS A LA 73
THIS 3/4 INCH
SIX METER TRANSMITTER
RTTY
CW
QRP
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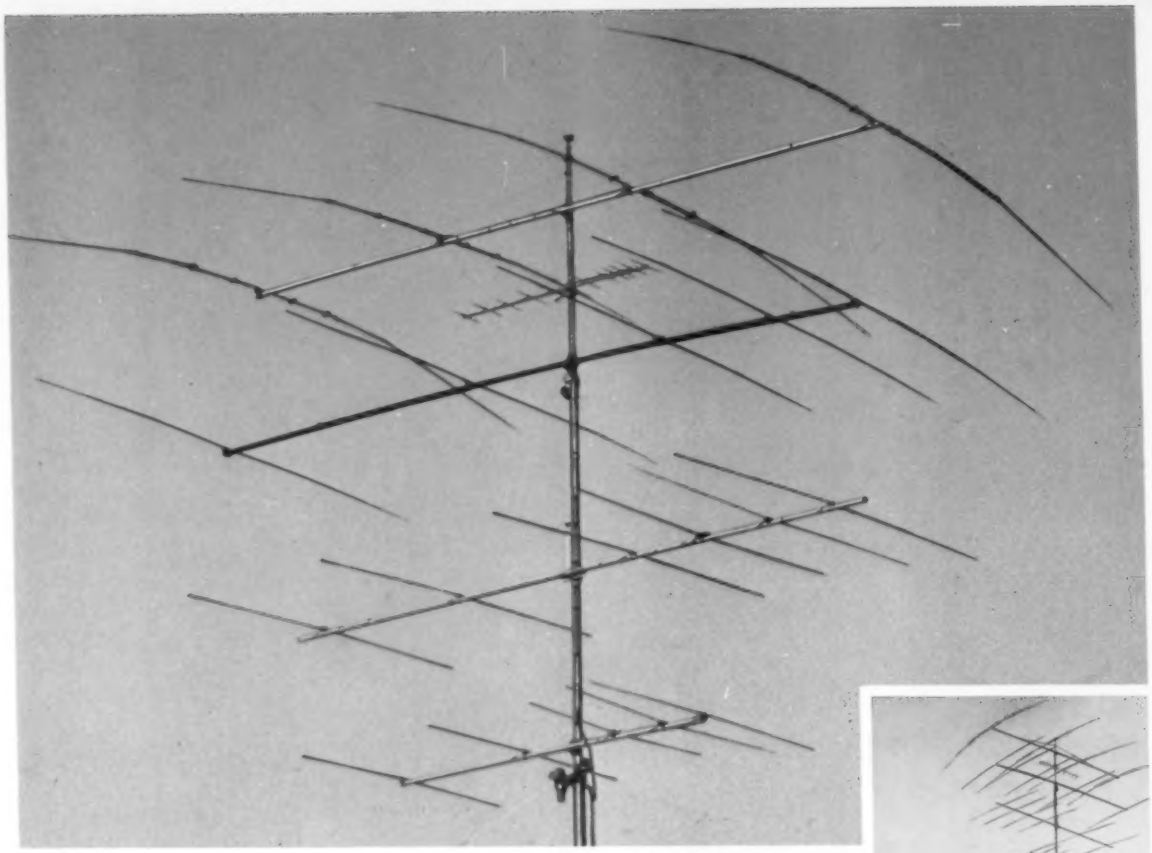

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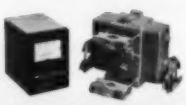

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TX OUTPUT
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SPURIOUS RADIATION
MINIMUM FREQUENCY DEVIATION
MICROPHONE IMPEDANCE
RECEIVER
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STEP SIZE
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NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

LEARNING CODE

While on the one hand I'm a bit concerned over the code courses that are proliferating ... thus inevitably touting some newcomers away from the *73* cassette series ... on the other hand I'm both surprised and delighted to note that none of the competitors seems to have yet grasped the basic concept of how code is learned and what the true significance is of the plateau in learning.

In every objective test of the effectiveness of code courses, the *73* series is at least twice as fast as the next closest course. How can that be?

Let's take a moment to consider just what it is we are trying to do when we learn the code. The usual way of starting the process is to enter the data in the mind, which enables you to translate a di-dah into the letter A, etc. First you memorize the dots and dashes for all of the letters, numbers, and punctuation. Then you listen to them sent slowly and mentally look up each dot-dash pattern in your mind, comparing it with the table you have memorized. When you get a match, your mind tells you what the letter is and you write it down.

Then you gradually speed up this process until you are operating at the fastest speed the mind can handle on a conscious level ... which means a code speed of around ten words per minute, give or take a little ... and in no case as high as thirteen (why do you think the scoundrels set the speed at 13?). No matter how hard you try, your mind can't go faster looking up each code group ... hence the plateau.

But obviously something does happen, for we have people who can copy code at close to 100 words per minute ... so there is a way past the plateau. What happens is that the code sound patterns ... not the dots and dashes themselves ... are automatically translated by the subconscious mind and the character comes to mind seemingly from nowhere. This is why good CW operators can sit and talk with you and then turn around and typewrite the copy they've been hearing while they were talking. The copy had nothing at all to do with the conscious mind processes ... it was all on a subconscious level. It is this complete retraining which produces the plateau.

The plateau is a long one because there is a long battle in your mind, with the conscious trying to translate the dots and dashes ... and not being able to keep up ... while the subconscious is quietly trying to get through and tell you it's got perfect copy ... shut up already with the other process. This battle defeats all too many prospective hams.

But is this whole battle really necessary? Why should we even bother to go through the conscious mind process at all, since it is of no long range benefit and in fact is about the worst possible way to tackle the project? Tradition ... as Teyve lauded in Fiddler. Tradition is still with us and bogging down tens of thousands of poor souls who are trapped by it. Tradition keeps the ARRL pursuing this system ... and sucking hundreds of ham clubs into it with the ARRL tapes. The *Ham Radio* tapes stick rigidly to the ARRL tradition. And so do most of the rest of them.

So how can code be learned without the old process? By starting directly with the training of the subconscious mind ... starting out above the speed the conscious mind can handle. I'll bet that a newcomer to Morse code can learn the code almost as easily at 25 words per minute as he can at five words per. He has to learn to recognize the sound pattern of the letters rather than the dots and dashes. Even at 50 words per minute, it doesn't take long before you can pick out the letter "E". Then you'll begin spotting the "I"s and so forth. If you let your mind go blank and listen to fast code, you'll start having the letter E jump right out at you with only a few minutes practice ... and gradually the other letters. You then have to train your fingers to type them as they come ... or to put them on your mental blackboard and copy them in your head.

There is a limit to how fast we can spell out words, even with the submind doing the work ... but I don't know what it is. I suspect that the high speed CW fans are copying words rather than letters ... particularly when they get up around 100 wpm. This is more like speaking a foreign language ... a lot like it. You have to use a foreign language quite a bit and continue to use it to keep it functioning on a subconscious level where you don't have to translate everything both on receive and send. Eventually you get so you "think" in the new language ... and this is the way of high speed CW.

A good Morse code course will start the beginner out with each character being set at the end desired speed ... 13 wpm. Then, as the subconscious gets trained, the spaces between the characters are closed ... but the sound *patterns* are kept the same. We're trying to recognize these sound patterns, and if we continually change them by changing code speed, we are essentially forcing the brain to start all over again. This is okay if you have the time and a world of patience.

Code instructors from clubs run into hard core cases where people are unable to learn even the whole alphabet. Their conscious mind just won't make the grade. I suggest that these people may well be able to do just fine on a subconscious training program. Send code to them from the *73* 13 wpm cassette and ask them to listen first for the E ... then the I ... etc.

The subconscious mind can do fantastic things. Many of the brilliant mathematical skills are done subconsciously. In fact, there have been many cases of people who were barely able to function on the conscious level, but who could do cube roots subconsciously. They didn't have any idea of how it happened ... the answers just came to them from nowhere.

During my years working as a psychological counselor, I used a direct approach to the subconscious to avoid the protection against mind repairs put up by the conscious mind. The subconscious mind is right there all the time and extremely easy to contact and use, once you get the hang of it. You're using it all the time ... trying to remember a name ... which "comes to you" a bit later. Or trying to solve a problem and a solution "occurs to you" later, etc.

Starting right out to learn the code with a 13 word per minute tape is a shock ... it staggers the conscious mind ... heck, everyone knows you can't learn the code that way. Nuts ... you can start out at 20 words per minute if you want, and you'll be able to copy it perfectly in a fraction of the time of the chap who starts out at two ... five ... seven ... ten ... plateau ... plateau ... twelve ... thirteen ... grunt ... and slowly upwards.

I have no doubt that loyal ARRL fans will continue to make life miserable for prospective Novices and Generals with the traditional code system as epitomized by the ARRL tapes and W1AW transmissions ... even though it goes against everything we know about how the brain works. In the meantime, those who have lucked onto the *73* cassettes will have a tremendous advantage ... and they will mostly end up enjoying code instead of hating it.

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which causes you a whole lot of pain ... and learning the code via the traditional method is a big pain in the ... ah ... mind. No wonder so few amateurs go on to stick to the CW bands! Code can be easy and fun, if it's taught right. It can be a skill to be proud of, and not a dark and unpleasant stumbling block which you have to overcome to get a ham ticket. Which way are you making it for the new hams?

AVUNCULAR ADVICE ASKED

You are probably not unaware that the Novice training courses started by ham clubs around the country are generating thousands of Novices and that the drop in the number of hams has been turned around. A good deal of the recent growth of readership of *73* has been due to these Novices subscribing ... mostly as a result of their use of the *73* Morse code tapes and the *73 Novice Class Study Guide*.

Perhaps you, as an old-timer, have some advice for these newcomers to our hobby. You may have an antenna that you think they should know about ... perhaps there is a rig that you think is great and you'd like to recommend ... maybe you have some modifications which would help them ... or you might like to suggest books or magazines which would benefit them.

You can reach these newcomers to hamming via the pages of *73* ... with a letter to the editor or perhaps a short article. It's easy to write for *73* ... just be sure to type it double-spaced so we can fix up them grammar or speling errors. Give these chaps a helping hand through *73*.

SIGNS OF DECAY

A letter from John Askew W4AMK suggests that every member of the ARRL hierarchy be required to read C. Northcote Parkinson's book, *Parkinson's Law*. He refers in particular to chapter six, which seems to almost have been written with the ARRL directly in mind.

The gist of the chapter is that the building of a well-planned headquarters is achieved only by institutions on the point of collapse. Parkinson has done his homework well on this, and gives voluminous proof to support his contention.

As far as I know, the members of the League were not consulted about the use of nearly $1 million for additions to the headquarters building. Here we are at a time when more and more amateurs are becoming seriously concerned over the approaching debacle at Geneva with the ITU and WARC ... and money that could have gone for some ham ambassadors to visit third world countries and garner support for amateur radio is being spent on newer, bigger, and better offices. Just think how far a million dollars would go toward protecting amateur radio!

Parkinson points out that a vigorous institution spends its time getting things done and pays little attention to its surroundings. A visit to the ARRL's enormous building, with its chrome furniture and pile rugs, can be contrasted with the utilitarian *73* offices, with old desks and a strictly make-do atmosphere. We have over 60 people working at *73*, jammed into a 250-year-old house and having the time of their lives.

It isn't until an institution is running down that it spends its time erecting an edifice ... and this turns out to be its monument to the better days of the past.

Here we are with the U.S. government ready to take away half of our 75 meter phone band and the whole 40 meter phone band as their official proposal at WARC ... and the ARRL is spending most of the money it has gotten from us over the years on administrative space to provide comfortable offices for even more assistants to the assistants.

You may put me down as being overly critical of the League only if you can come up with an alternate proposal which will help protect amateur frequencies and include spending $800,000-plus for more office space in Newington. I don't think anyone has more input on what is really going on than I do ... and I see no cause for complacency.

SELLING THE SALESMAN

I'm a real sucker for anything new ... and Chuck Martin WA1KPS, down at Tufts Radio, knows it. I blundered into his store the other day to drop off some of our newly published books ... *The New Hobby Computers* ... and the store was so packed with hams that I had trouble finding a spot to park! Chuck was up on the roof putting up more antennas.

Once he was back on the ground and we'd eyeballed for a while, I mentioned that my IC-230 had one lamp out ... maybe he could fix it. Oh, pshaw, he said (or words to that effect), "Why are you driving around with something as out-of-date as that? You should be using the latest in digitally-synthesized ham gear." That sounded good to me, I admitted ... and before I knew what was happening, my IC-230 was out and a brand new IC-245 was in. I sure hope he gets a good price for the 230 for me.

The IC-245 is quite a step ahead. No longer do I have to be bewildered over the 15 kHz splinter channels. I had 'em all on the IC-230, but I never knew which was which, and when I visited another area I just had to fly blind. With the 245 I get a readout of the receive frequency when receiving and the transmitting frequency when transmitting. I can program the darned thing for 600 kHz splits, for 1 MHz splits ... or any other splits that repeaters may come up with. It knows all about transmitting high in the 147 band and transmitting low in the 146 band, but this can be defeated for the upside downers.

After some months with the 700A Kenwood at the home shack, I have been accustomed to tuning in the receiver with a regular tuning dial ... and liking it. They sure don't hide any repeaters from me any more! The 245 tunes the dial in 5 kHz synthesized jumps. This makes it so I can tune up and down the band, checking active repeaters as I go. If I want to break any of them, my transmitter is right on channel automatically. No more trying to remember if the upper/lower switch is in the right position ... no more using a switch to go from the 146 segment to the 147 ... and the whole package isn't any larger than my old IC-230.

Chuck was so slick about it that I never did notice when I had agreed to take the thing ... he just assumed that I would, and the next thing I knew I was driving away programming the new rig as I went. I did have to run a separate power wire for it to keep the synthesizer powered. When you turn the rig off with your ignition switch, you then have to reprogram the synthesizer again — and that gets old. You can use a transistor radio battery for the keep-alive current, if you are too lazy to run the extra wire.

And that isn't all. The audio from the 245 sounds a whole lot better, both on receive and transmit. Mr. Inoue, you've done it again!

SPIES NEEDED

If you are anything like me, once you get your hands on a tunable two meter receiver, you set about making a list of every repeater you can hear ... and every simplex net. You look for the inputs of strange repeaters and get the call letters of all that have any identification ... and listen a lot on the channels of repeaters which are obviously being kept sub rosa. In other words, you are curious and a snoop.

If you are cut from the same bolt, how about making a copy of your list of repeaters and sending it in so we can be sure to keep our repeater list updated? We'll update the *Repeater Atlas* and publish late changes in *73*.

We want to keep the *Atlas* as up to date as possible as a help to traveling hams ... so do your part ... be sneaky and send us your secret agent reports ... send them to Fearless Leader, *73 Magazine*, Peterborough NH 03458. That goes for DX hams, too, by the way.

HAMS VS CB

For some reason I seem to get a lot of newspaper clippings from *73* readers which involve CB radio. I have two things to say about this ... first, please keep it up. I appreciate every clipping you can send me about CB (good or bad) ... about ham radio ... or about any of my other not too secret interests such as Jordan, submarines, UFOs, microcomputers, and things like that.

A recent clipping sent in by good friend K7EML was an ad in a newspaper for a 100 Watt CB amplifier (not to be used on CB) for $120. This points up a question ... is the FCC serious about CB linears or not? Another dealer ran an ad for a linear in a magazine and got a phone call from Charlie saying in effect to go ahead and sell 'em, but don't advertise, because that would force them to put on the heat.

Even though about 80% of the new hams are coming via the CB ranks, there is a question in my mind as to whether what goes on there is really any of our business. We don't mix with the mess on the marine channels ... or the terrible things on taxi and police channels. CBers have no patent on bad language over the radio. CB is another separate service, and I feel like we're butting into a family problem ... someone else's family ... when we get involved with CB.

Since I do write a weekly newspaper column for CBers, I have a personal interest in CB ... not a whole lot ... I don't get involved with any base station baloney or rag chewing with base stations. My column is mostly devoted to explaining the facts of life to CBers and pointing out the advantages of getting into hamming ... what skip is and why ... what the sunspots are going to actually do to them ... stuff like that.

WAYNE TALKS

I'll be on the program at Atlanta on June 18-19th ... come armed with questions. I often forget to cover things people want to know about, so make notes and bring 'em. I'll also be talking at Seattle July 29th, if you're in the vicinity. Both of these are going to be superb conventions, so I hope you'll be there and say hello.

COMPUTERIZED POLICE

More and more police departments are following the lead of the Las Vegas PD and installing computer terminals in the road cars. This permits them to check on car licenses automatically and find out if the car is wanted anywhere in the country (or if there are any warrants out on the registered owner). The whole business takes about 10 seconds, versus the pre-computer time period of 10 minutes or more.

The police officers were against the innovation, but when they found out how useful it was, opinion changed. It didn't help when one officer got involved with using the terminal while driving and wrecked the car, the terminal, and almost himself. Most of the officers now pay more attention to the rules about stopping before using their terminals.

The system provides automated dispatching of the patrol cars and automated report writing, in addition to the computer data base on people and car licenses.

In Washington DC, this has made it possible to check on parking tickets quickly and put one of the "Denver" yellow boots on the wheel of a car which has outstanding tickets against it. The boot locks on and keeps the car from being moved until the owner settles up on the unpaid parking tickets.

HAM COMPUTERISTS

I've been asked to give a talk on the ham uses of computers at the 1977 World Altair Conference in Albuquerque (May 3-7). Although I've heard from a few hams who have been using microcomputers, there are a lot of you out there who haven't written. I'd appreciate getting as much information as possible on any applications you may have developed.

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LETTERS

PART 97.112

Federal Communications Commission
Washington DC 20554

This is a request for the FCC to consider modification of FCC Rules and Regulations, Part 97.3(b).

I propose that the following words be deleted from the part mentioned above: "and without pecuniary or business interest."

This particular phrase, while questionable as to its intended implications, is virtually unenforceable, the subject of wasted controversy, and overtaken by events that continually transpire on repeater autopatch facilities.

It is agreed that Part 97.112 is valid and needed regulation; however, the broad and ambiguous wording of Part 97.3(b) is detrimental to the amateur service because of the unnecessary confusion created by it.

While the primary reason for requesting this change is to realize the full advantages of repeater autopatch technology, the parallel case is operation of the Class D Citizens Band under Part 95. We have virtually no difference between a Class D operator ordering a pizza via his CB radio or an amateur doing the same via a repeater autopatch – except that the former is authorized while the latter is steeped in controversy. The question of avoiding telephone company tariffs is moot, because in the case of the CB operator the telephone is avoided completely, while the autopatch is providing an income for the phone services.

Your expeditious consideration of this subject is solicited and a copy of any germane request for comment or rule and order is hereby requested.

William J. Howard
FPO San Francisco

HAM SCHOLARS

The Foundation for Amateur Radio, Inc., a nonprofit organization with its headquarters in Washington, D.C., announces its intent to award four scholarships for the academic year 1977-78. All amateurs, wherever resident in the U.S. and holding an FCC license of at least General class, can compete for one or more of the awards if they plan a full-time course of studies beyond high school.

The John W. Gore Scholarship pays $750. Applicants must intend to pursue a career in electronics or a related science and have completed at least one year in an accredited college or university toward a baccalaureate or higher degree. Preference will be given to residents of the District of Columbia, Maryland, and northern Virginia.

The Richard G. Chichester Scholarship also pays $750. Applicants must be members of the ARRL and be sponsored by an ARRL-affiliated club. There is no restriction on the course of study, but applicants must be enrolled in or have been accepted by an accredited university or college and intend to seek a baccalaureate degree. Preference will be given to residents of Ohio, Kentucky, Indiana, Illinois, the District of Columbia, Maryland, and northern Virginia.

The Edwin S. Van Deusen Scholarship pays $250. Applicants must have been accepted or enrolled in an accredited 2-year technical school and intend to seek an Associate degree in a science-related area. Area preference is the same as the Gore Scholarship.

The Radio Club of America Scholarship also pays $250. There is no restriction on the course of study, but applicants must be enrolled in or have been accepted by an accredited university, college, or technical school and intend to seek at least an Associate degree. There is no area of preference.

Application forms can be requested from FAR Scholarships, 8101 Hampden Lane, Bethesda, Maryland 20014. Requests must be postmarked prior to June 1, 1977.

The Foundation is devoted exclusively to promoting the interest of amateur radio and to scientific, literary, and educational pursuits that advance the purposes of amateur radio.

Foundation for
Amateur Radio, Inc.
Washington DC

TV 3320

The following is a rundown on my experiences with the TV Typewriter 3320 designed by Jeff Roloff and sold by Mini Micro Mart. Possibly you haven't built this model TVT, but maybe my experiences will help you in shooting trouble with the one that you are building. This happens to be the third TVT that I have built, and each time the various models develop new problems, so this time I am going to put into writing the problems that I ran into. I feel sorry for the fellow 40 miles from nowhere who runs into some of these problems.

First off, the delivery of the kit was somewhat late. Apparently the supplier of the PC board lost the prints and didn't make delivery on time. So really this was not the fault of Mini Micro Mart. I would like to make mention that when I called Mini Micro Mart, they at least answered the phone, and at one time accepted a collect call from me. I completed the assembly on Christmas Eve, getting all of the bugs worked out at that time. It prints a very nice copy.

One of the things that I would highly recommend you use is the timing chain waveforms if you have a scope but don't have a counter. Most scopes will count the crystal frequency and then the prints indicate the divide by n as you go through the circuits or ICs. If you lay out the exact number of waveforms on the scope for the input frequency (let's say 10 square waves to start with for 10 mm of deflection), then if the timing chain indicates the next test point is half the frequency, you will come up with 5 square waves for 10 mm of deflection (which says that the next IC has divided by 2).

As you go through the complete timing chain, you will note this takes place. Also, any offsets will be apparent. Also, if you take a ruler and extend the various waveforms back up the sheet, you will see where they compare to some previous waveform that should indicate whether the circuit is working correctly or appears to have trouble. As you continue down the chain, you will discover where the scale changes, and you will have to recalibrate the timebase (frequency of scope) setting of the scope. This will give you a new setting to start with, and then you can continue from there. Frequencies in the timing chain of Mr. Roloff's TVT all come out correctly. I also found that the timing chain in SWTP TVT #1 came out OK; I built two of their units.

Getting back to the TVT 3320: I found some printing errors on the schematics. In Fig. 16 showing timing, the output of IC #2 pin 9 is L or 7920 cycles, pin 8 is M or 3960 cycles, and pin 11 is N or 1980 cycles. All of these terminals and readings are correct. These frequencies go to IC #14, and this is where the first error occurs. The first error shown is L going to pin 13 – really it's N. Pin 9 of 14 shows N going there, and it's really L (the final addition of the frequencies comes out OK, but if you attempt to check the input to IC #14, it can throw you). L1 comes out 7920, which is correct from the timing chain. I might mention at this time that L1 and L1 bar are the same frequency-wise but have a phase reversal; that is, the wave train on the scope will be right side up for L1 and upside down for L1 bar.

Also at this point, I would like to mention that the waveforms should be all of the same height. I had a condition where I had 5 mm of height going into the IC but less than 1 mm of height coming out of it (due to a small piece of wire from a piece of steel wool that had accidentally gotten onto the bench). A defective IC following this loading effect can also cause loss of power in the drive.

Another schematic error is in Fig. 16 on timing. IC #17 pin 3 is shown as going to Fig. 18 (next line blanking), IC #41 pin 11. Instead, IC #17 pin 3 goes to IC #12 pin 11 and then IC #12 pin 10 goes to IC #26 pin 5. So IC #2 is used in place of IC #41 as this particular inverter. The final frequency and inversion is correct, but if you are tracing trouble with a scope, you can be talking to yourself.

At this point, we were feeding a composite video signal into the video display. The problem was that we were getting broken and distorted letters and numerals. The consistent thing was that any letter trouble was always the same as if it were hard-wired, which indicated that the trouble was not a spike or frequency problem. The trouble appeared as if maybe a solder ball might be underneath some socket (which I used throughout).

At this point, I used a piece of wire from the five volt supply with a 330 Ohm resistor in series, and touched terminals 17, 18, 19, 20, 21, and 22. This will give a letter display on the screen as follows: 17 will give an AT's in some circuits, but in this circuit it gives an A; 18 terminal will give a A when an AT's appears before, but if an A appears, then a B will appear; 19 will give a D on the full screen (same as above); 20 will give an H; 21 will give a series of P; and 22 will give a blank. You can tie any or all of these input terminals together, and get any letter or numeral in the ASCII code. With this type of input, I proved that the trouble was either in the 2513 character generator or the 74166 shift register. The only letter that was distorted was the A, as on both outputs the above letters were all OK.

I now duplicated the circuit of the 2513 and 74166 on my proto board and fed the output into the transistor buffer that fed the video display. Lo and behold, all of the letters and numerals that I could generate were alright.

Now the problem was to find the cause of the trouble. At this point, I would like to make the comment that I have found that you can short the inputs and outputs of the 2513 and the 2519 and the 74166 and not get into any trouble.

So I started by shorting the outputs of the 2513 character generator, which is also the input to the 74166 shift register. As I am going along, I discover that I can duplicate my exact condition by shorting pins 6 and 7 of the character generator (which says I have duplicated the trouble). This bears out the above assumption that it must be hard-wired and possibly a solder short. After looking very closely, I conclude that the trouble has to be under the 2513 character generator.

Well, this is a 24-pin socket soldered to a double-sided board, and God had better be with you if you are going to unsolder and remove the socket. After very careful consideration, I decided that unsoldering was not the answer. Rather, I took a small screwdriver and pried the plastic holder up, leaving the terminals soldered into place. It came off very easily, and nothing broke, believe it or not.

Now I checked terminals 6 and 7 with a continuity meter again and the

short was still there. Getting the magnifier into operation, I could not find a solder glob of any size. I did find an eyelet just barely touching a piece of foil. This was corrected with a very sharp knife, and the short disappeared on continuity. The black plastic form for the 2513 socket was gently pushed back on the soldered terminals and then taped into place, and everything looked real good. I fired up the TVT and it worked beautifully — giving me the excellent Christmas Eve present of a workable TVT, which I believe was worth all the trouble I went through.

George F. Hatch W9VMG
Fort Wayne IN

NITTY GRITTY

I am a CB to ham convert. I came across a deal on a SSB CB radio in Sept. '76 that I could not pass up. It was installed in my vehicle and I listened (not having anything to say) on various AM channels for about two weeks. I found for the most part that it was crowded with people who had nothing to say.

The next step was to try upper and lower SSB. I did and could not make sense out of what I heard on the channels. Somewhere along the line, I found lower 16 and intelligible conversation. It didn't even resemble the nonsense on AM.

I found a "home" for listening on lower 16, but I did not understand a lot of things, i.e., QRT, QSY, QRX, go down ten, Apache 45, Ex-Calibre 99, etc. I found no one used their FCC callsigns. Anyone not conforming to procedure (using the 10 code, AM talk, using callsigns) was quickly ridiculed by the "knowledgeable" frequency cops. I once heard a guy call, "CQ 11 meters — CQ 11 meters," to which he received a chewing out about not understanding radio. (Only now do I realize that the poor guy was probably only a ham with at least a General ticket and more radio knowledge and ability than anyone on 16.)

One way or another, I came in contact with one of the SSB club members, went to a meeting, and joined the club (needed one of those funny callsigns). I learned what the codes meant and messed up my radio with all the "trickstuff" a good SSBer has.

I was OK for about three months, until I finally realized that I was running as illegally as possible, going nowhere, calling myself an 11 meter radio operator (never a CBer) and being just plain frustrated.

Several members of the club have ham radios they run on 11 meters only (what a waste). I saw their radios and knew I had to have one, but it would never transmit on 11 meters.

I dropped out of SSB, sold my radio, passed my Novice written back in January, bought a radio and am awaiting my ticket.

Now the nitty gritty!

I turned on my radio tonight to monitor the Novice bands. I tuned 40 meters and found a QSO where the guys had a good fist and were a little faster than I could copy (good practice). All of a sudden, right on the frequency of a QSO, some lid began tuning up and calling CQ.

This is not the first time I heard this, but tonight it made me sick and reminded me of CB.

I did not try to put down CB, but ham is heads above. It makes me sad.

Louis C. Berry
Simi Valley CA

P.S. You do not have to plead with CBers to upgrade to ham. It takes some longer than others, but it is a natural transition (if they will spend as much time learning the code as they do bad-mouthing it).

What more can we say? — Ed.

WORD FOR WORD

I hope that you will print this letter word for word in *73*.

To begin with, I am sorry that I have ever spent a cent for *73 Magazine*. I feel that the magazine spends a lot of space on slandering — that's right — slandering the ARRL and its publication *QST*. If you use all of the space that you waste doing this on amateur radio issues, you might find that radio would benefit from it.

For example, in February, 1977, *73*, we find Wayne Green attacking the League on the WARC. Nowhere in his editorial did he offer any concrete evidence on what the ARRL is doing. Unless he can back up malicious statements like "... but I know they are far more interested in spending $800,000 on a new wing for the HQ building than trying to protect our bands." Wow! A magazine that would print such a thing as this with not one single word of supporting evidence (i.e., names, dates, places, or even quotes from the WARC) must be a really poor publication. I don't know how many hams have benefited from the HQ services, but without the nightly (and daily) code practice sessions, I am sure that there are many hams out there who would not have gotten their General (and above) tickets. (By the way, I don't see *73 Magazine* operating a service like this to the amateur radio community.)

Come to think of it, and correct me if I am wrong, outside of publications of various kinds, I don't see where *73* does anything at all, save sit around and condemn the ARRL. It is easy to sit in a chair and say what the ARRL is doing and what you *think* they should do. After all, you're not the one who is doing anything, except perhaps misconstruing and taking out of context everything in a League publication. You aren't in the position where decisions have to be made, and sitting in a chair with a good hindsight is a lot easier than having to make the decisions.

Then I read articles like "Talk About DX — WOW!" in hopes of finding out some new research in propagation and see how much of a waste of space it is. Or then there is "CB Can Do Some Things Better." Could we have these spaces filled with something worthwhile about amateur radio? (Before the CB world comes down on me, I have a CB and a license for it, but if I wanted to know something about CB, I would go to a CB publication.)

Then, the mere fact that you print some of the letters you do — do you select as many anti-League letters as you can? Letters using great and outstanding examples such as HAL discontinued a keyer or that one of the thousands of electronics companies has a PEP wattmeter and then saying something like,"ARRL is really on top of things," just shows how foolish these readers are. I hope that if they miss anything in the field they are in for a career, that their credibility will never again be trusted. (By the way, if I may use the same unsupported logic from these people, if *73* has ever printed an ad for Trigger, which I have also had trouble with, I hope that we realize that it is not as interested in the amateur radio world as it is in securing advertisers to increase its greedy income — see, I can speculate too — but, in doing so, I have condemned everyone who writes or works for *73*. Are you letter writers really using your heads?)

I am not saying that *73* is all bad — I have seen good things. But some changes have to be made. For instance, when the term "dBm" is used in the "Novice Q & A" column, it ought to have a definition. Many beginners, as well as old-timers, may not understand such things, as the only place I have seen it is in the commercial broadcasting.

Secondly, if you, or any of the letters you publish, condemn the ARRL (or any other organization), do it — but don't do it without any proof. I have seen no proof of any kind that is substantial enough to say the ARRL is doing more for themselves than ham radio or that they are behind the times.

The space you waste on condemning the ARRL and then the fact that you don't seem to be doing anything about it really gives me a negative attitude on the whole magazine. In fact, it is hard to trust the credibility of any article in a magazine whose editors spend their time blatantly cursing everything else. If you are against something and can show substantial evidence, then I might withdraw my ARRL membership. But as it stands now, you only help support my belief that the ARRL is the finest organization available to amateurs. If you want to put the ARRL down, quit talking and get up your own teams of lobbyists and go to the WARC. Prove yourself. I am only sorry that readers often tend to listen to writers of poor editorials. If everybody agreed with your philosophies, then we would all read *73* and the FCC would be able to pass any regulation they wanted to and amateur radio would be the loser.

I hope that you will publish this entire letter, as I feel that it has a lot to say. I am sure that a lot of readers will condemn me for this letter, but if they cannot prove their points by showing good evidence that I am wrong, then they only prove my point further.

David O. Wever WB2CQX
Greenwich NY

73
Study Guides
and
Code Tapes —
The Best Available
see page 196

GOOD BUDDY

Received my March issue of *73* today. While I am a very recent subscriber to your publication, I must rate it tops in its field. No offense intended to *QST* or *CQ* magazines, as I have subscribed to both of them in bygone years.

First off, I was a ham long before the 11 meter Citizens Band was even thought of. I used to work the 11 meter ham band, as I am almost certain that Wayne Green did (judging from his call letters). The thing that irks me, and probably most hams who did not rise from the ranks of the CBers, is the very fact that we were chesed out of the 11 meter band, in order that it could be handed to a group, on the proverbial "silver platter," and used in the same manner in which the hams had been using it. Except, no examination requirements were involved. This provided many would-be hams with a cheap and effortless way to enjoy hamming. This probably was not the intent of the FCC. But, what else could the FCC expect? After all, a person who did not possess enough intelligence to plug in an electric coffeepot could obtain a Class D Citizens Band license, with no questions asked. That is, provided he or she met the age requirements and could produce the license fee. Pretty cheap price to pay for hobby-type communications privileges.

Many articles which are published in *73* seem to promote the idea of ham clubs going all out to recruit prospective hams from the CB ranks. This seems ridiculous to me. If these CBers had desired to become hams, they would have done so in the first place, the same as thousands of us did in years past. I am employed as an electronics technician for a railroad, and have a shop in a terminal. Many railroaders, who are also CBers, come into my shop, asking if I can furnish them with railroad frequency crystals for their CB rigs. The railroad radios operate on approximately 1-3/4 meter FM. These same people refer to themselves as radio operators (not as electrical appliance users). When mention is made to them that they

may be interested in becoming a ham, the first question is, "What have I gotta do to get a ham license?" When the ham licensing requirements are explained to them, the immediate response is, "too much trouble." One young man accepted my offer of assistance, and is now a very devoted amateur radio operator. So, it is possible to make a radio operator out of a CBer.

I was amused by the letter from Jim Cullen WA2ENR, in which he asks, "Where would hams be without CB?" I wonder if Jim believes that all hams rose from the ranks of the CBers. For his information, there were hams long before CB was even thought of. As a matter of fact, there have been hams since the very beginning of radio, as we know it today.

There are many complaints of jamming, tuning up on net frequency while nets are in session, profanity — the list could go on and on. This is not good for ham radio in general. It seems as though this sort of thing has become more prevalent within the last decade. One cannot help but wonder if these offenders did not rise from the CB ranks.

Anyone reading this letter may draw the conclusion that I am down on the Citizens Band radio service. That conclusion would be far from true. However, I am down on the inconsiderate people who use this band strictly for hobby purposes. CB was intended for small businesses and individuals who had need for an economical two-way radio service for business use. Many persons who invested money in CB equipment for business use soon learned that CB had been taken over almost entirely by "The Good Buddy Set," who can talk all day and say nothing.

During the 25 years that I have been a licensed ham, I have tutored many people to hamdom. I have lost count of the number. This was not done through a recruiting program. Anyone who expressed a desire to become a ham received my encouragement, cooperation, and assistance. If we go out and start a full scale recruiting program from the CB ranks, we might well end up with the 80, 40, 20, 15, 10, 6, and 2 meter Citizens Bands. There is strength in numbers, but quality should also be given some consideration. Lest we forget, hams must demonstrate their ability as radio operators before they are permitted on the air. Let's keep it that way. Let us not permit people to become licensed amateurs simply because they have enough money to purchase a ham rig. The ham license has already been cheapened enough.

Verle D. Francis WØSZF
McCook NE

220-420 CB?

This letter is regarding the use of 225-420 MHz by the government and the letter by Merrill See W8BGZ, of Kalamazoo MI. Although I am not a government agent who can give you an official report, I can give some informal information as a bit of background.

For the past 8 years I have been a Ground Radio Maintenance Technician (that is, a radio repairman) for the US Air Force. A major portion of my job in that time has been with radios that operate in the 225-400 MHz frequency range. These radios are used mainly for Air Traffic Control (ATC) of military aircraft. They are also used extensively for other information to pilots, and for command and control. These uses mean that these radios are used continuously on a 24-hour, 365-day-a-year basis. The only thing I've ever run across that is used more is CB's channel 19, and the VHF ATC radios used by both the military and civilian airports. To open this frequency range up to Citizens Band type use would require that not the military but the Congress of the United States and the budgetary bodies of many foreign countries allocate a very large sum of money to scrap a working worldwide system and design something new to replace it with. Moving all operations to the VHF ATC frequencies would not work, because of the increase in congestion and because some places use more spectrum space than is available in the entire VHF ATC band (which in itself is larger than the entire 2-30 MHz HF range).

The 406-420 MHz band is also used worldwide by the military. Although it doesn't carry as much traffic as the 225-400 MHz band, it is used daily for ground mobile radio service. Moving this would also be an expensive proposition.

The preceding is not meant to be a complete report; it is just my observations of one user that I have worked with on three continents.

As an answer to question #3, "Careful evaluation of the priorities of the needs of the United States Citizens," I personally think our needs are being served fairly well for an important purpose on these frequencies. They are not very visible to the public, but they are used extensively for a public service.

If anyone still wishes to convert these frequency allocations to a direct citizens' use, I recommend that they practice by removing their local police, fire, and other government services from the frequencies now used by those services.

Ronald E. Seibel
Edwards CA

NEW DIMENSIONS

My three-year-old son is one of the estimated 335,000 Americans who cannot hear any speech; he is able to hear or feel sounds below 800 Hz only with much amplification. Unlike the many blind who are able to participate in our hobby, he and another estimated 13,000,000 hearing-impaired persons have, by the nature of our early emphasis on audio communications, been excluded.

We do have one thing in common — the desire to communicate. FCC code regulations would seem to limit licensing, but my son Kurt can recognize most of the code alphabet and will certainly be able to copy as soon as he can write (although much of the chatter on our CW bands is trite and hardly a learning experience).

In the past few years, relatively expensive telephone TTY equipment has been offered to the deaf. The slow data rate utilized by most limits use to local calls, but mass production should bring the cost down and thus make for more availability to amateurs. I am sure you can see the possibility of a "deaf net."

A new, exciting communications mode has been made available to us through the efforts of the Public Broadcasting Service and FCC order RM-2616. If you have ever tried watching TV with the sound off, perhaps the Muppet Show, you soon realized that something is missing. PBS has developed a system by which captions can be sent on the previously unused scan line 21.

Persons desiring captions would use a simple decoding device. Mass availability of this device, estimated to cost around one hundred dollars commercially (probably less through our surplus channels), would also give us easy access to any TV for TTY, computer, or code conversion uses.

The basic system is described in graphic form in Figure 17, Section 73.699, of the television standards.

Line 21 would start with the normal blanking pulse and program color bursts. This would be followed by seven cycles of an approximately 0.503 MHz signal to synchronize the decoder clock, two cycles of spacing, and then 17 cycles to transmit two 7 bit plus parity ASCII characters. Line 21 of the next field would be used to send a 9 bit pseudo-random framing code to indicate where the two characters should be located. Each eighth frame would consist of a pulse to set the zero crossing bias point.

While this system has the disadvantage of slow speed (52.5 characters per second or 630 5-letter words per minute), it has the advantages of being CMOS-compatible (cheap), not sending unless space data (the pseudo-random code) is provided, and requiring minimal onboard memory.

It should be obvious that dropping the clock run-in, slowing the clock rate to one telephone-compatible, and adding memory would allow the same system to be used for other purposes.

A letter to your local PBS station might speed adoption of this system, and give us yet another equipment dimension.

Our efforts to introduce the deaf to our newer modes of communication might well add a new dimension to our hobby.

Lawrence E. Stoskopf, M.D. WØPSF
Wichita KS

LEVY REPLIES

I would like to take a moment to correct a gross misrepresentation of the facts presented in Mr. Briggs' letter in a recent issue of *73*. It can be expected that there may arise misunderstandings in business dealings, but there is no excuse for distortions of the magnitude represented there.

Mr. Briggs purchased a prescaler kit in February, 1975. Nothing was heard from him until the summer of 1976, over a year later, with a complaint about low sensitivity. A suggestion regarding the possibility of shorted input protection diodes was made, and a set of diodes was sent, free of charge, for him to try. Failing in that, I advised that the cost of a new scaler chip, if that were the problem, would be about $35.00. He subsequently returned the unit, advising that the diodes did not cure the problem. He had mounted the scaler board in a box, from which it was removed, and examined. The difficulty was in fact a defective chip. There was a delay of several weeks prior to the completion of the repair, for various reasons. It was decided to make the repair at no charge. The chip was replaced, the unit reinstalled in Mr. Briggs' enclosure, tested (despite what Mr. Briggs may say), and the unit and his check returned. A nasty letter containing the same allegations as in his letter to *73* arrived a couple of weeks later.

If Mr. Briggs had taken the trouble to open his box and examine the scaler prior to making his allegation, he would have noticed that the chip had on it a date code subsequent to his original purchase date, which is pretty good evidence that it was in fact replaced. The unit was tested prior to being returned with an in-calibration $2300 signal generator; why it did not function for Mr. Briggs is merely conjecture on my part. However, any suggestions to remedy the problem were cut short by his letters.

There are no other manufacturers that I know of who do service on kits eighteen months after sale for free; Mr. Briggs might like to try that with a large manufacturer and see what happens. In any event, there is no excuse for accusations of "sunshine" repair at any price when they are simply not true. Mr. Briggs would do well to check his facts next time.

Stanley P. Levy WB6SQU
Levy Associates
Monrovia CA

CB TO 10M

I just read your article in the *73* Holiday edition, 1976, about the possible changes of CB equipment to a usable 10 meter system. This sounds great to me. I am a frustrated CBer who is working on a ham license.

I fell in love with 2 meters during my recent exposure to The Salvation Army work in Guatemala, where I was responsible for establishing an emergency radio system. We used 2 meter equipment with a repeater on top of a mountain for 200 mile coverage of the area. Now I just need that extra push to get at least a Tech level.

But back to the article: This is something that needs to be followed up with some organized system. There sure are a lot of people with closets like mine, used to store CB equip-

ment. It just got too noisy!

Keep up the good work. Could you put in some novice (simple) projects for beginners? I'm not quite an electronics engineer yet — but working on it!

Fred Musgrave
Baltimore MD

We have a series of CB to 10m conversions coming along, Fred. With the current depressed prices of 23 channel equipment, the time is right to obtain a rig and get in on the fun on 10. See you there. — Ed.

BRIEFS BOOSTER

The recently expanded "Briefs" section is great. Warren Elly is to be commended for his efforts in searching through countless club newsletters to keep us all up-to-date on interesting news. I have seen to it that *73* has been added to the mailing list of *Spark Gap* from the Two Rivers Amateur Radio Club.

After reading the Editorials, Briefs, Be My Guest, Looking West, the FCC news (with and without commentary), and the vast quantity of readers' letters each month, I find myself very well informed on what is happening in ham radio. The rest of the magazine seems like a free bonus!

Also like the corrections letters grouped together rather than scattered as they were in the past.

Don't change a thing (except for the better).

Joseph R. Nelis, Jr. K3JZD
Trafford PA

THE RASCALS

I find myself puzzled at the logic of many of the amateurs who write letters to *73*. So many complain that ARRL is not representative of the amateur fraternity and that *QST* simply does not fill the bill as a "ham rag," so — as so many have written — they refuse to join the League until *QST* becomes the kind of magazine they want.

In view of the fact that ARRL is a membership organization, and that *QST* is its journal, the way to *least* affect the nature of the organization or the content of its journal is to resign or not join. That leaves it with members like me who like the journal as it is now published — in fact, it gives us almost total sway in keeping it much as it is now. Quitting such an organization and railing at it from the outside is much akin to telling the baseball team you'll quit and take your football home if they don't let you be the quarterback, when every other member of the team has a football in his hot little hand. Obviously, your leaving makes it even easier for the rest to do things without regard to your wishes.

If you honestly want to see change — in what is clearly an important spokesman for amateur radio (perhaps in a way you dislike) — don't quit. Join, and get your buddies to do the same. Then "vote the rascals out," electing directors who espouse your point of view and who will move to make *QST* what you want. I'll still be there trying to buck you, but I don't even have to try while you're outside. Obviously, the League must, legally and morally, pay more attention to my wishes than to yours. After all, I am a member.

Don't holler at me in the pages of *73* (to which I am also a subscriber). Join the League and take me on where you can influence the things you dislike.

David G. Boyd WA9GBW
Waukegan IL

You could not have summed the editorial position of 73 more concisely, Dave. For your information, most of the hams at 73 are League members. — Ed.

A WORLD OF GOOD

First of all, thanks to you and your fine staff at *73 Magazine*. You've done it again. Through an unfortunate mistake, I lost my faith in Heath Electronics, and with your help all is going great guns again. They *do* stand behind whatever they sell . . . even to the point of refund. So, here is to Heath, keep up the good work.

Another unbelievable first for a "biggie" — I wrote KLM Electronics concerning technical advice on their PA10-160BL 2 meter amplifier, and guess who I got an answer from? Mr. Leland M. Farrer wrote me personally and in simple terms, so a lid like myself could understand. He explained my problem and how to correct it. This exchange of information took less than ten days. Now we know why Mr. Farrer is president of KLM; let me say they are fine folks to do business with!

Just one last word about you and *73 Magazine* — please, please, keep up the good work. So many amateurs become discouraged too easily with one thing or another and give up this fine hobby. But, with your help, the editors' "feedback" section, and reporting good things along with the bad, it does us all a world of good. Please accept my personal thanks for making my hobby much more fun!

David L. Martin WB9UKJ
Evansville IN

MISUNDERSTOOD

I would like to come to the defense of a group of misunderstood people.

After reading in your magazine about "steely-eyed" examiners, and such comments that would make someone think of the FCC as an enemy of sorts, I cannot hold my silence.

Having taken my General, Advanced, and Extra class exams, all from the Boston office, or outlying examination points, I have never gotten an unkind word, and, as a matter of fact, have found that these people really extend themselves to help you, and make you feel as relaxed as they possibly can.

They won't break any rules for anyone, but we really couldn't have it any other way, could we?

Your books are great, and I could not have gotten my Extra without their help.

E.L. Melanson W1HOB
Montville ME

A SWIFT KICK

The controversy about I/O is still going on, in spite of the handwriting on the wall, huh? Please do me a favor and eliminate all that wasted space devoted to DX, super basic electronics, CW, 6800 micros, RTTY, history, etc. I am really not interested in any of that. (Did I miss anyone's toes?) Oh, the argument is that there are magazines devoted to computers, and you should leave it to them? How about saving the space you waste on contests? "You know who" has many, many pages of contest data every month. Leave it to them.

Seriously, a year ago, I could have written a 10 cent article (at your rates) about everything I knew about computers. Now (the XYL will never forgive you) I have George Morrow's 8080 and I am slowly putting a system together. Who knows? Another year and I may learn some programming.

By the way, how about asking those wonderful, talented Fergusons if they could rewrite that OS (Ahhh! beautiful system) for 8080 with no monitor. You could probably find a half page to print the dump.

As far as leaving I/O to computer magazines, I am a charter subscriber to *KB* (same as in the radio area, only 1 mag) but *KB* is not really the place to print Oscar locator programs or (dare we hope?) Don Alexander's program for winning RTTY contests without even being there.

I have only one complaint. Why didn't you give me a swift kick at an RCB meeting many years ago, when I didn't give you my $37 for a lifer?

Al Klein W2PMX
Miller Place NY

SOFTPEDALING

I really have enjoyed *73* the last three years and am looking forward to the next 36 issues.

One thing, though, for *myself* and perhaps many other hams — I hope you soft-pedal the I/O section. There are so many areas of amateur radio, e.g., slow scan, ATV, Oscar, and many others that we haven't touched yet, that there is no time for I/O.

The amateurs who have been at it for years and have explored all the other facets of the hobby perhaps go for it, but I changed to *73* because it had more projects for the *average* ham, with more down-to-earth projects. Don't spoil it all.

73 is put together nicely, and the advertisers I have dealt with, such as James and Poly Paks, have given good service. I don't always agree with your ideas, but that's a free press.

D.S. May WB8ATR
Van Wert OH

Sorry 'bout that, Don. If you check through past issues of 73, I think you will see as many "general" articles as always, including the I/O section. Computers are to some as RTTY is to others, and should be considered a special interest area of ham radio. I don't think you would knock the RTTY content of 73, so lay off those who are interested in computers — everyone has his thing! — Ed.

1635 UTE

Recently, while monitoring 3725, I began to note a strange popping coming over the speaker. At first I did not pay too much attention to it, as QRM and QRN are quite commonplace on all the bands. As the intensity increased, I suddenly realized that my antenna was being bombarded by a form of radiation. The longer I sat there, the more intense it got. I began to get a little shook, having kept track of the latest Chinese nuclear explosion for a while after, due in part to its size and the cloud it had created. I called the local police to find out who monitors the environment in this area. I was told they couldn't help, as they had no contact with any group or individual who did. Then I called the local air base and the operator put me in contact with base environment. I was told that their reading was normal. I couldn't believe it, so I called downtown to the American Atomics Corporation to see if they would take a reading for me. Their man had already gone home for the day, but an individual gave me the phone number of a local civil defense official here in Tucson. His secretary told me she would try to locate him and ask that he call me, and he called in about ten minutes. I explained to him what was happening over my receiver and he said that he would take a few readings and call me back.

He called back and notified me that I had nothing to worry about, as they could not detect anything more than normal. About 30 minutes went by before Les Heru W7WIT called and gave me another number to call. This is what I learned. Some parts of the universe are studied more than others, and our area, the Crab Nebula, is studied rather extensively — in the constellation of Taurus the Bull.

Recently, a strong emission of gamma radiation was detected in a tight band of wavelengths coming from the Crab Nebula pulsar. This radiation is caused by positrons (a subatomic particle the size of electrons but opposite charge) and electrons destroying themselves.

Some of this radiation may have been what I heard coming over my speaker. I really can't say without more research, but as the Chinese radioactive cloud created by their latest endeavor was out-of-phase with my QTH at the time, it is unlikely that it was the cause.

If some of the hams who read your magazine have also heard this, I would like very much to hear from them as to time of day and date and approximate intensity. What I heard came over the speaker 19 Jan. '77 and seemed to peak out at 1635 UTE. The sound is somewhat like popcorn being popped or, for those of you who have heard radiation in a geiger counter, the sound is the same.

Bill Morris WB7ETZ
Tucson AZ

Are you sure it wasn't a noisy 12AU7, Bill? – Ed.

POTSHOTS

In the March '77 "Letters" column, Bob Billson WA2TXY, regarding the 1976 Hudson Division Convention, complained that "he could not afford that type of a hamfest and that it cost $4.00 to get into the flea market." In addition, he felt it chased CBers away. Well, Bob, I've got some news for you – the convention (not hamfest) registration cost was $4.00, which included all forums, exhibits, flea market, and hotel activities. Forums take a lot of time and effort, besides expense, to put together. They are a platform for exchanges of ideas and a place to learn. Anyone can wander around a flea market all day – it's only one part of a convention.

Over a hundred of your fellow hams spent 12 months of spare time and time off to put it all together, not to mention considerable personal expense, and we had to buy our own $4.00 tickets. We don't deserve cute potshots by people who don't take the time to find out what it's all about. The hotel was sold out . . . and over one third of the registrants were CBers who thought more about the hobby than you did. Many of them requested training and license information. If you can find us a site and workers to put on a hamfest for three to four thousand people at no cost, please let me know. By the way, have you ever attended a convention?

As for cheap shots from the Editor regarding nonprofit organizations, you should be interested to know that we donated $1,000 to the ARRL for WARC preparations and $500 to AMSAT. So go the profits. We welcome requests for funds to be used by worthwhile national and division projects. See you in '78.

Henry Wener WB2ALW
East Hills NY

OKALOOSA

The time has come to take my favorite editor to task with respect to the article "CB Can Do Some Things Better" by David Norman in the March, 1977, issue of *73*.

I would like to correct some implications in the "Public Service" section with respect to Hurricane Eloise. First, we hams did not fold our tents and fade into the sunset when the repeater went down. We knew for a long time that our split site repeater on Okaloosa Island was vulnerable to high water. Therefore, our emergency plans did not include a great dependence on WR4ABZ. (As a matter of interest, the repeater was off the air for less than 24 hours.) Our operations shifted immediately to 52 and 94 simplex. Even when the antennas were lost at the Civil Defense Center (primarily due to the wind loading of the large CB antenna on the mast), WB4VJP, the Civil Defense Station, was back on the air in minutes with an emergency antenna.

As far as "the odds of having two units equipped with 2 meter rigs in both those places at that particular time," there was at least one instance during Eloise where a heart attack victim was provided rapid ambulance service because there were 2 meter rigs at both the emergency shelter and the hospital.

In addition to the local communications efforts, local hams handled hundreds of pieces of traffic from all over the country with relation to Hurricane Eloise, a function which cannot be supplied by CBers.

I do not mean to downgrade the effort put forward by the local CBers (which was outstanding), but to dismiss the effort of over 40 local hams with "and then the lights went out all over town" is, to say the least, misleading.

You would have been surprised, and pleased, at the number of hams that showed up with HTs, battery packs, mobiles and home stations with emergency power, and spent many hours in public service during Eloise. Further details on Hurricane Eloise can be found in the February, 1976, issue of (excuse me) *QST*.

Please keep up your usually good editorial work with *73*.

S.M. Allen K4JEM
President
Playground Amateur Radio Club
Fort Walton Beach FL

NUTS!

I haven't had any gripes with your magazine until now.

I am speaking about the article in the March issue, "CB Can Do Some Things Better."

That article should be in a CB magazine. If a person wants to read about CB, just pick up one of the tons of CB mags on the market. I want to read about stories pertaining to ham radio. If you ask me, the article had no place in *73*.

Not taking anything from *73*. It's still a great magazine.

John Kotras WB9UIL
Milwaukee WI

Nuts! We have had several letters like yours concerning the CB contents in 73. I find it hard to believe that hams are still affected by the '60s CB image. Personally, I became a believer this winter when, had it not been for a CB radio, I would have spent several cold hours on the shoulder with a broken fan belt. No, John, we are not becoming a CB magazine, but 73 definitely feels that CB has its place when it comes to public service. I really wonder if you've ever listened lately, John, or is your reaction to the article purely emotional? – Ed.

KEEP ON FIGHTING

I am currently awaiting my Technician license and am interested in 2m FM. I would also like to take this opportunity to congratulate you on an extremely fine magazine. I have recently had 2 letters from the ARRL wanting me to join. Hi hi. Who are they trying to kid? Keep on fighting them and the FCC. Speaking of the FCC, I had passed my Tech exam on November 12, 1976, but still no license. I see no reason for an over 12 week wait for it. They did not even reply to a letter I sent over 3 weeks ago concerning this. All this government nonsense has got to stop, but I see no solution myself.

Finally, I would like to commend International Crystal for their prompt and friendly service in processing a recent order, not to mention your own in sending me the back issues I requested. Also thanks to John King W9KZO for his patience in getting me started in ham radio.

Steve Royer
Greenville IL

500 MILS

Re: "Logical Storage for Logic," March issue.

Enjoyed the article very much, as is typical of your articles. A couple of points/hints:

1. The technique adapts readily to CMOS by the simple expedient of laying a sheet of aluminum foil over the styrofoam. For best results, bond it with glue to keep it from tearing as parts are inserted or removed. This keeps the device pins shorted, preventing static buildup, which is the major problem in CMOS storage. (Always be careful not to touch the pins when handling the devices. An easy way to extract them is to use a plastic alignment tool to pry the parts out.)

2. Conductive foam solves the whole problem. This is what commercial bulk users use (among other things). It is available in reasonable quantities from distributors or bulk IC users, who often throw it out after the parts have been disposed of.

3. Spacing between pin rows is almost always 300, 400, or 600 mils, never the 500 mils stated.

Frank Bates W6IPB
San Jose CA

CUSTOMER SERVICE

This letter is about an unusual company, Godbout Electronics. Last May I bought their 8 Amp 12 volt power supply kit. In October, when I finally got around to putting it together, it drove me crazy trying to figure out why it would only produce 300 mA before shutting down. A letter to Godbout brought suggestions from Kevin Fisher in their service department. More pulled hair and no solution. Another letter and a reply with a new pair of pass transistors and an offer to fix it free. I could not find the problem, so off to the post office with my 300 mA supply. I enclosed a check for return shipping. The supply returned with the check. Thanks, Godbout, for your assistance. Thanks for being a company providing outstanding customer service.

Ross Weber WA5SHA
Killeen TX

PONIES?

By gosh – I've sure heard about the lousy service for some outfit named Trigger, but let me tell you the other end – the business end of the rifle – Bullet Electronics of Dallas sure gives service to their customers. I ordered one of their kits on Feb. 7th, sending a personal check in payment. They received it on Feb. 12th, shipped on Feb. 14th, and I got it on Feb. 18th. How's that for real service?

Now if we could only convince Uncle Sam to stop using ponies – and – well – I can always dream, can't I?

Bob McCormick K4FRX
Columbia SC

A GIFT HORSE?

I have heard a lot of on-the-air criticism about Docket 21033, but those who criticize should ask themselves, am I, or am I not, mature and responsible enough to operate? Yes, there is the possibility of another CB-type bedlam situation developing, but the amateurs I know and associate with are mature enough to handle this relaxation of rules and expansion of privileges. For those who are against Docket 21033, I feel you don't realize that you are looking a gift horse in the mouth and, by rejecting the docket, I feel that you are saying that you are an irresponsible person unable to accept the additional responsibility the FCC is willing to give us. I am willing and able to accept it, are you?

Bill Fulcher W4AST/K4RTA
Hendersonville TN

For the uninitiated, 21033 is the "Repeater Docket" that would, among other things, allow HF repeaters. See Jan. 77 Briefs. – Ed.

HATS OFF

Let me tell you about the "GOOD GUYS." I have been a ham for about 15 years, and have been buying equipment for just as long. In all of this time, I have not found a dealer that I trusted 100%, that is, until Electronic Distributors, in Muskegon, Mich. Some time ago I called them and spoke to Carl. At this point I ordered 2 Kenwood TR-7400As. Right from the start I was told the truth! I was told that the rigs were back ordered, and that I might have to wait 4 to 6

weeks. I sent in a check for a deposit and asked that they ship them C.O.D. Some time later, the active filters came, but no radios. I called; Carl told me that they were shipped 3 weeks before my call. He told me to please give it a few more days and then call back. Well, a few days later the radios came and in good shape. My hat is off to Carl and all the boys at Electronic Distributors. Keep up the good work – they will be getting more (all) of my business!

Keep up the good work!

John M. Bernstein WB2GKT
Midland Park NJ

RECOVERY

I would like to congratulate the members of the Birmingham Amateur Radio Club who participated actively in advertising the fact that some amateur equipment was stolen last December from the Instructional Resources Center of the University of Alabama in Birmingham. This equipment was to be installed in our ham shack. The equipment was a Yaesu FL2000B linear amplifier and two Yaesu digital readout devices, as well as an antenna.

Thanks to the Birmingham Amateur Radio Club, in cooperation with the University of Alabama in Birmingham Radio Club, the equipment was retrieved by the University Police and the culprit will be prosecuted.

Robert M. Ervin WB4VNH
Instructional Resources Librarian
The University of Alabama
Birmingham AL

THE I/O DEBATE

I really like the articles on amateur radio. I will cast my lot with those who say keep the I/O portion to an absolute minimum or else *73* will lose its spot as one great amateur publication. I know there is a lot of interrelated theory, but if you broaden the scope of your magazine too much you will lose the amateur radio buff. Personally, I could care less on what makes a computer tick or how to build or program one. *73* can either be a good amateur publication or a good computer publication – but not both. Somewhere it will cross that dividing line and just fade into a blur of images.

Paul Overdier WBØODK
Westminster CO

BIRDSHOT

I only wish I had subscribed to *73* years earlier! It seems you should start a column devoted entirely to Trigger Electronics, Inc. Up until last month, when I inherited a year's back issues of *73*, I gave Trigger the benefit of the doubt *and* my money. I have suddenly realized that my three or four polite letters to Trigger were like using birdshot on a rhinoceros, and I will have to develop stronger weapons. My thanks to your "Letters" column and WBØPTM (June '76) for the ammunition. Wish me luck. Meanwhile, I have sent for *your* code tapes to begin my long-awaited start in hamming (which has been waiting since May '76 for code tapes from Trigger). I am looking forward to your sensible code approach. Much thanks for an alternative to the ARRL method, which I hear "ain't so hot."

Keep up the good work, and count me in on your side.

Sam Prepelka
Pittsburgh PA

BUILT-IN STATIC

Can anyone top this for a code course on records?

I have a set of five 78 rpm records put out by the "Victor Talking Machine Company in collaboration with the Marconi Institute" in 1918. These recordings are all in the old spark gap mode and progress from the basics to 20 words per minute. Boy, talk about weird-sounding code. The last record has built-in static to teach operators to pick the code out of the QRN. Imagine the task those brasspounders had in those days, picking manmade static out of nature's.

This course was put out to train World War I Signal Corps operators, but the cover says, "commercial students and amateurs may, through these records, become competent operators at home or in camp." So hams had recorded code courses almost 60 years ago.

Elmer W. Hill W8RFB
Wakefield MI

EXTRA CLASS

I had found a note in my 21 wpm code tape that asked for some comments as to the value of the practice tape in preparing for my Extra Class.

I first started out with the 14 wpm and, after copying about 70% of it, I started with the 21 wpm. Both tapes are excellent practice, because when copying tapes of mixed groups, you have no time to think about what is next and it starts to become automatic in a sense.

The FCC has changed the written exam, so you cannot memorize the license manual and pass the test. Some of the questions on my written were right out of the blue.

Cliff Riley K9ZPN
Fort Wayne IN

HOME BREW

I built this transmitter from scratch using mostly parts from my old black and white TV set. I have had many QSOs over the years with this little rig and a great many inquiries about it, so perhaps somebody will be interested in seeing it.

The circuit uses a 6AU6 VFO, 6W6 driver/mult. (TV audio output tube), and a pair of 6QD6s in the final (TV horiz. output tubes). And if my measurements are correct, I run a maximum of about 160 Watts input with about 120 Watts out.

John C. Conner
Chattanooga TN

Come to think of it, I haven't seen a good tube article come in for quite awhile – hmm. – Ed.

GREENBAUM REPLIES

This is in reply to WB6OIM's comments in Letters to the Editor, March, 1977, to my gross oversight by not touching upon the subject of 10m FM in my January, 1977, article, "Ten Meters: Dead Or Alive?"

My article simply explains one facet of enjoyment on 10m, namely Ten-Tenning. I did not intend to imply that any mode was better or more fun than another. This is a personal preference and also subject to considerable controversy.

I also would like to see more use of FM on 10m with a possible gentlemen's agreement to keep it on 29 MHz and above, avoiding the Oscar downlink frequencies, of course.

He mentions the thrill of working your next-door neighbor through a repeater 3000 miles away. Is this really necessary when you can do it simplex with a milliwatt?

Propagation conditions being alike, to work a DX station on FM with full quieting will still take an appreciable increase in power over other modes and can still be worked on SSB with a fraction of that power. Again, this is a personal preference.

To monitor 29.6 for band openings would prove fruitless if no one was on at that time or if the channel was being used by locals. This is why I prefer monitoring 24-hour beacons in different parts of the world to see if an opening has occurred and to where.

I do not intend to degrade FM, as it has proven its worth tenfold on the 2m band. My personal preference, as far as DX is concerned, is still SSB for its efficiency whether it's on 10m or 2m. To each his own.

Ten Meter Beacons

They transmit a carrier with CW identification.

Call	QTH	Frequency (MHz)
VP9BA	Bermuda	28.165
VE3TEN	Canada	28.175
ZC4RY	Cyprus	28.180
GB3XS	England	28.185
3B8MS	Mauritius	28.190
WA1IOB	Massachusetts	28.150
DLØAR	Germany	29.000
JA1GY	Japan	28.200
XL2HMF	New Zealand	28.170

Martin Greenbaum K2HTO
Bronx NY

SORRY 'BOUT THAT

In your Novice Q and A for March 77, you state that a transmitter can easily be set up for CW operation by plugging an af oscillator into the mike jack, and keying it.

A setup like that will have us Novices producing MCW or A2 operation, definitely a no-no on any Novice band, or any band at all below 50.1 MHz.

Please make the distinction between doing the above on an AM transmitter and an SSB rig (the latter will produce A1 operation).

Thomas Marquardt WB9UHX
Sharpsville IN

John Conner holds his home brew transmitter built from his old TV.

Briefs

Compiled by Warren Elly WA1GUD and Stan Miastkowski WA1UMV

Got a good ham radio news story? Drop us a line, or call it in, and take home the 73 publication of your choice, provided we publish your news tip. Be sure to specify which book you want. OK?

The WARC situation is not looking much better. The latest word from our Washington sources relates to the upcoming 5th notice on the frequency allocations tables proposed for the 1979 WARC conference. (A fourth notice will probably not contain any reference to the frequency allocations.) In the 5th notice, due out by late spring, the FCC is expected to drop two large segments of the 75m and 40m amateur bands. The proposed table (which still, of course, must withstand WARC scrutiny in 1979 and domestic debate at the FCC level) calls for *elimination* of amateur allocations between 3.9 and 4.0 MHz and between 7.2 and 7.3 MHz. Both segments would be allocated for international broadcasting. These latest developments would seem to indicate a better chance of amateur allocations at 10, 18, and 24 MHz, although they would probably be shared with other services. Underscoring the FCC proposals is word from the Canadian DOC, whose WARC allocations plan should be public by the time you read this. The DOC plan would also delete 3.9-4.0 MHz, along with 3.8-3.9 MHz, from amateur use. As for 21 MHz, the word at deadline was that there is a good chance of restoring the band to its original status of 21.0-21.450 MHz.

Senator Barry Goldwater K7UGA has again introduced RFI/TVI legislation in Congress. The bill, assigned number S-864, resembles previous RFI bills Senator Goldwater has written, all of which failed due to heavy lobbying by the manufacturers. Goldwater's latest bill would force TV sets and hi-fi equipment to be designed with better front ends and suppression.

Contrary to some conflicting reports in the media, instant upgrade of amateur licenses was effective at all FCC field offices on the first day of March. Initial reports from around the country indicate that offices have been packed to the walls with applicants during the last few weeks. In a *73* interview, Frank Skeiber, examiner at the Boston office, said that since the elimination of the license fee and the start of instant upgrade, Boston and many other field offices have been forced to schedule a separate day for handling the crush of applicants. Although Skeiber declined comment on the percentage of applicants who pass their exam, he did indicate that it seems that many people feel that with the no-fee test, if they don't pass the first time, they can try again.

The on-again, off-again comprehensive code exam plans of the FCC are on again ... this time, FCC spokesmen say, the exams will begin nationally on or before July 1st. But, it is important to emphasize that target dates have been set before, and a call to your district engineer's office *prior* to taking the trip may be in order. The word at deadline was that the code exam tapes had been duplicated, but the latest hang-up was the actual written exams.

As many prospective Novices have discovered, the FCC goofed on one version of the current exams. A circuit diagram Ohm's Law question is impossible to answer in its published form, so Gettysburg has been instructed to give all applicants taking that particular exam credit for the question.

We're still scratching our heads over this CB QSL from Switzerland. It came addressed to "BX 250," Peterborough, but we've been unable to find anybody answering that description. The Swiss op reports BX 250's signals were 58 to 9.

W1AW may be losing its license! That's if an FCC proposal becomes law. It all started with the incredible flood of license applications (CB and amateur) that has swamped Gettysburg since the first of the year. Over a million applications were received in January alone, and amateur applications reached the highest rate in history — well over 21,000 received in a month! A thousand 1x2 callsign applications were coming in per week at press time, and secondary license applications (undoubtedly fueled by the suspension of license fees) were coming in by the hundreds. By late February, FCC staffers were scrambling for a solution, and the results may not be very easy for most amateurs to swallow. The Commission has frozen all new secondary call applications, and proposed a rule-making which would eliminate club and military club calls, secondary tickets, RACES calls, and special events calls. What's more, the proposal would phase out all existing secondary and club calls upon expiration. (The proposal may well be modified to set up a specific expiration date instead.) In the future, all calls except 1x2s and 2x2s for Extras (yes, 2x2s) will be issued systematically, thus eliminating all other requests for special or reassigned calls. The docket, assigned number 21135, can be commented upon until June 2nd, with reply comments due by June 30th. Needless to say, a strong reaction is expected from the League, as well as from clubs now holding club calls.

Hidetsugu Yagi, the man who did pioneering work on antennas in the early 1920s, died in January in Japan. He was 89. Besides the antenna that bears his name, Yagi did the first work in UHF. In 1926 he had equipment working on 2.5 GHz. Thanks to *Break-In*, the Journal of the New Zealand Association of Radio Transmitters.

Amateur radio played a big part in the Visveswariah Industrial and Technological Museum Science Fair in India this past January. According to the *ARC News Letter*, published in Coimbatore, VU2VTM was on 40 meters for the entire week of the fair, with more than 200 QSOs logged. Leaflets explaining amateur radio were distributed to all visitors, with a lecture transmitted by VU2ARC on the final day of the event. Incidentally, in the January *ARC News Letter*, 30 US stations were listed as being worked/heard by VUs, although only five made the difficult 20m SSB list — KP4AST, WA3TZT, WA4AMJ, WA4KMY, and W4JY.

Smokey reports don't violate the law, ruled a judge in Pontiac, Illinois. A CBer was cited by a state trooper for "obstructing a police officer," after the CBer gave the lawman's position over the air. The Radio Association of Erie PA said that the state is considering an appeal.

In an effort to decrease the amount of HF activity, the FCC is continuing to take legal action against members of the so-called "HF International" group. Late in January, show cause license revocation orders were issued against 21 alleged members of the group. According to a source at the FCC, six of those requested hearings, twelve waived a hearing, and three did not answer and were considered to have waived hearings. As this issue of *73* was going to press, the first of the hearings were taking place in Houston TX and Sacramento CA, before administrative law judge Walter Miller. Also scheduled was a hearing in Los Angeles on the renewal of the amateur license of Jack Randall, the alleged publisher of *SSB News*.

Meanwhile, the enforcement division of the FCC continues to work around the clock to apprehend offenders. Field Operations Bureau Chief Richard Smith told *73* that the 13 fixed monitoring stations have increased their staff and added a number of mobile monitoring vans. Smith added that the main concerns of the FOB at the moment are operators using illegal high power and the TVI that results.

In a related development, an Atlanta GA area CBer was recently sentenced to 90 days in jail on charges of using obscenity on the air. It's the second conviction this year that has resulted in a jail sentence.

The FCC's bandwidth docket (20777) may be delayed, but it's not dead. In early March came the first Report and Order on bandwidth (more are expected to follow), which sets harmonic and spurious emission limits on all amateur transmitters. The specifications call for suppression of at least 40 dB under carrier level for emissions under 30 MHz, and 60 dB for emissions between 30 and 235 MHz. The regulation affects *all* amateur equipment, whether home brew or commercial. FCC spokesmen say they believe most amateur equipment currently in use can pass the specifications, which in essence adopt the ITU standards recognized around the world. Another angle is that FCC engineers believe the new limits are likely to give them another handle on "black box" amplifiers and CB transceivers that are manufactured under the guise of being amateur gear. Keep in mind that this is not a proposal — it becomes law in late April.

From one end of the country to the other, the interference problem continues to grow. In northern New Jersey, an amateur who saved the crew of a ship in trouble in the Caribbean (see "Be My Guest") continued his fight against a $2000 fine over zoning regulations and towers. In Texas, the state legislature saw introduction of a bill that would put $100 fines on interference convictions, without even considering the equipment being interfered with and the possibility that it could be at fault. Representative Samuel W. Hudson III reportedly introduced the bill after a citizen in

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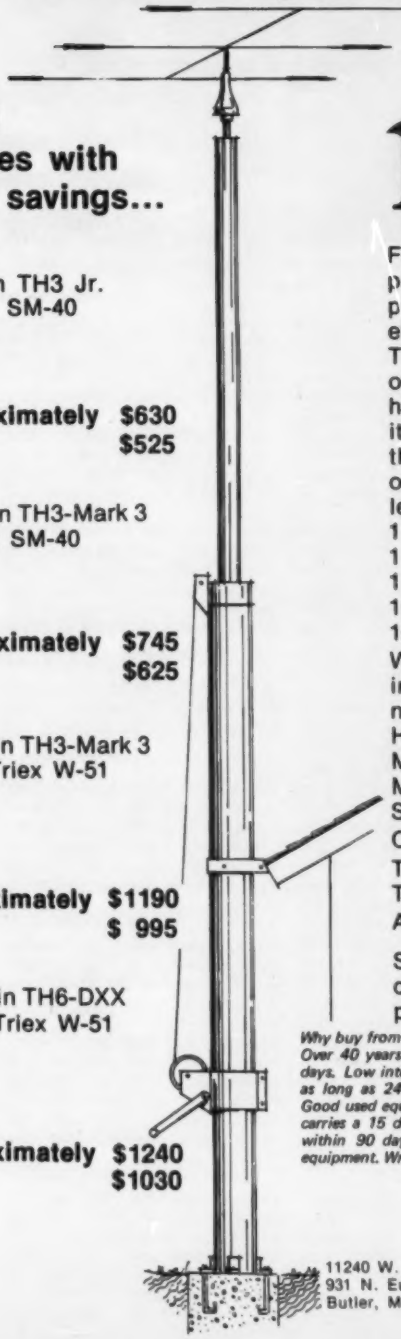

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Swan TB-3HA or Hy Gain TH3-Mark 3
Tristao MM-40 or Triex SM-40
CDR Ham-II
RG-8 100'
Control Cable 100'
Retail Price: approximately $745
Package Price: $625

Package No. 3
Swan TB-3HA or Hy Gain TH3-Mark 3
Tristao CZ-454 FS or Triex W-51
5' mast
CDR Ham-II
RG-8 100'
Control Cable 100'
Retail Price: approximately $1190
Package Price: $ 995

Package No. 4
Swan TB-4HA or Hy Gain TH6-DXX
Tristao CZ-454 FS or Triex W-51
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H3

his district got nowhere with a TVI complaint to the Dallas FCC office. After some quick jawboning by the American Radio Council (led by Frederick Maia W5UTT), Representative Hudson agreed to let the bill die in committee. According to a report in the *Atlanta Journal and Constitution*, the National League of Cities is circulating a proposed model ordinance which would limit antennas to no more than 25 feet off the ground or six feet from the rooftop. In Lee, Massachusetts, a CBer was ordered by a district court judge to stop "the annoyance" of stereo interference. He ruled that RFI/TVI represents a disturbance of the peace. The CBer was given thirty days to comply. John Gallo, of the Personal Communications Foundation (PCF), was quoted as saying, "What we are experiencing is a crisis of unprecedented proportions . . . law suits are falling like rain in a hurricane against two-way radio operators." (The PCF has taken the position that interference ordinances are illegal because they are discriminatory and in violation of the 1934 Communications Act.) And in an AP story datelined Washington, Senator Barry Goldwater K7UGA was quoted as saying that he has an inexpensive remedy when neighbors complain about interference: "I just pick up a .00 or .50 resistor and go over and install it for them." We're hoping AP might run a correction, or, as K8QQN put it in a note accompanying the clipping, "Barry, I think you have a great idea, but I would stick with the first value of the two resistors." Thanks for the above items goes to K8QQN, WA4FSK, W5UTT, and WB2NEL.

The pressure on amateurs from the big money groups continues as WARC '79 draws closer. Recent spokesmen for the broadcast industry have noted that their services address millions of people every day, while the total number of amateurs is less than 300,000. Also mentioned was the fact that a comparatively large portion of spectrum space is assigned to amateurs which "could be better utilized elsewhere" . . . like broadcasting. Thanks to the *West Coast DX Bulletin*.

Reports continue to filter in to *73* of the valuable emergency services provided by amateur radio operators during the snow and cold weather that hit the east and midwest early in 1977. The Holland MI Amateur Radio Club reports that area hams manned CD and National Guard emergency shelters throughout the emergency. At several points, overloaded telephones caused 2 meter autopatch facilities to be used.

Alien hams operating in the U.S. under reciprocal agreements must still notify the FCC when operating portable. Although U.S. amateurs need not notify the FCC of portable operations, aliens must still file form 410 with Washington.

Hank Greenberg W2LTP, of Cranford NJ, saving lives and fighting to keep his antennas. Photo courtesy of The Daily Journal, *Elizabeth NJ.*

With all the controversy surrounding strict new tower ordinances and RFI complaints throughout the United States, *Overmodulation*, the newsletter of the Poinsettia Amateur Radio Club in Ventura CA, reminds us that it was the case of Whitehurst vs. Grimes in the United States District Court for the Eastern District of Kentucky in 1926-1929 that *denied* municipalities the right to regulate or restrict amateur operation.

Some postscripts to reports on the 220 MHz CB situation — *Sight and Sound Marketing* quotes Hy-Gain cofounder Andy Andros as supporting 220 CB. "It's a bad situation in that there are five megahertz of band space (at 220 MHz) occupied by only some 250,000 to 300,000 amateurs, and of that number it's estimated that only 150,000 at most, are active . . . on 220 MHz, it's estimated there are fewer than 3,000 amateurs who have had any equipment since the beginning of time." As for the amateur service, the other founder of Hy-Gain, Ted Andros, is quoted as saying that ham radio may have outlived its usefulness as a generator of technological developments through experimentation. Andy Andros (the Hy-Gain president) is quoted by *PerCom* as saying, "It is a national scandal that 2,000 to 3,000 people (hams) can hold on to that space, when 15 million CBers could use that band . . ." Thanks to WB2VUJ, WA2JXE, WB2ZLA, and *CFAR News*, Oak Park IL.

One area of interest to the authorities is the merchandising of "black box" linear amplifiers and amateur gear to CB types. The mailing of these advertisements may be in violation of Federal law. We are looking for any ads mailed to our readers, for the purpose of forwarding to the FCC. Especially of interest are sale sheets (and other paraphernalia) aimed at dealers. Several we've received include 100 to 500 Watt amplifiers, labeled "illegal for use on 11 meters." Think about the mark-ups on these TVI/RFI generators — a 100 Watt "bi-linear" which puts out "an honest 100 Watts," list $179.95, dealer price $92. Or a "Pride DX300 500 Watt Amature Linear" (their spelling), which promises a $200 profit for dealers. The same wholesaler proudly announces availability of a major line of amateur gear, just above his listings for "common mixer crystals" — great for putting that 11m rig up onto the "HF" band (or sliding a ham transceiver down to 11 from 10m)! Thanks to WA1FIH.

Before the FCC released its proposed ban on the sale of linears capable of 10 and 11m operation, the San Antonio Repeater Organization had already filed a counterproposal. The club's docket and legislative committee chairman, Robert Weaton K5PKK, says that abuse of the type acceptance exemption by manufacturers and dealers has made new regulations mandatory. The San Antonio group's petition asks the FCC to restrict the sale of transmitting and rf power gear to licensed persons, establish a dealer licensing program, and provide for mandatory penalties against anyone involved in the unlicensed use of transmitting equipment. As for type acceptance, the San Antonio petition argues against it: ". . . We submit that the inclusion of amateur equipment into the type acceptance program would fail to get to the heart of the problem. Conversely, a total ban on all forms of linear or rf power amplifiers . . . would be shortsighted and prejudicial to many lawful and conscientious users, but would also fail to stop the availability of high-powered transmitters to unlicensed operators. The amateur transceiver offering a power input of two kilowatts PEP, with 11m "receive only" provisions, would simply replace the lower powered versions currently available."

The San Antonio petition concludes that the issue is not the actions of the majority of radio amateurs who would be affected, but instead commercial greed. "We are hopeful that strong regulation of sales will stop the rash of new state and local laws attempting to deal with the radio and television interference problem, most of which . . . usurp the Commission's authority to regulate transmission of radio signals."

Our friends to the north have not gone unaffected by the linear amplifier problem. Shortly after the FCC proposed a ban on the manufacture and sale of commercial amps covering 24-36 MHz, the Canadian DOC released a plan of its own. According to reports in *The Canadian Amateur*, the sale of amplifiers would have to include (within ten days) paperwork addressed to the DOC. Specifically mentioned in the Canadian proposal is the General Radio Service (CB), but the Amateur Service is not mentioned. The proposal calls for $1000 maximum fines and up to a six month jail term. Editorializing on the DOC plan, *The Canadian Amateur* didn't seem very optimistic: ". . . this measure is coming on the scene too late to prevent the present chaos prevailing in the GRS, which sports illegal transmitters, illegal amplifiers, illegal procedures and various and sundry other illegal operations, much to the detriment of those who need the service for legitimate purposes." But the strongest point of the editorial was aimed at the DOC itself. ". . . In our opinion, this amendment will be as useless in cleaning up the situation as the rest of the Radio Act has been — unless the political leadership of the DOC and its top management show some fortitude in enforcing the proposed amendment and the rest of the Radio Act and the Regulations . . ." Along with the linear amplifier proposal, however, the DOC moved against RFI/TVI on the manufacturer's side. The plan would ban the sale of "machinery, apparatus, or equipment that causes interference to radio reception," within yet to be defined (at press time) limits. Yet another section of the Canadian proposal limits the sale of emergency locater transmitters (ELTs) to aircraft and seaworthy vessels. The closing date for comment to the DOC was March 17th, although an extension had not been ruled out at deadline.

A stolen repeater? Yes, unfortunately that's right. WRØALU, the only free-access autopatch repeater in Minneapolis/St. Paul MN, abruptly went off the air on March 2nd. The 16/76 machine, located on the 23rd floor of the Shellard Tower building, had been vandalized. Left behind were

the transmitter and receiver strip, but the autopatch and duplexer had been ripped from the rack. The thieves apparently jimmied a stairway door. Owner KØFHC was expected to have the machine back on the air by the time you read this. Thanks to WBØSCV.

Still more changes in the works at FCC — the Commission has proposed eliminating the 4 month requirement for notification of a change in station location. According to FCC staffers, the idea is to leave notification up to the judgment of the individual amateur — keeping in mind the remaining regulation that FCC mail be able to reach you promptly. Another issue under consideration is elimination of group Novice exam mailings, a procedural matter not requiring a rule-making. FCC spokesmen say that hams have let them down by failing to send back unused exams, so the result is counterproductive. Instead of cutting the paperwork, as the FCC had hoped, only more paperwork has been created!

With the release of the dockets on linear amplifiers and type acceptance of amateur radio equipment, the FCC also had something to say about ham radio. Chairman Richard Wiley wrote of his reservations, "... While I concur in the Commission's proposals to ban use of linear amplifiers in the 11m citizens radio band, and to require type acceptance of amateur equipment, I must admit to doing so with some reservations ..." Wiley went on to say, "... in attempting to deal with the rapidly proliferating and sometimes troublesome CB service, we may appear to be penalizing the amateur community which, in my judgment, is one of the most professional and self-regulated services within the Commission's jurisdiction ..." And Wiley concluded that, whatever happened to the linear amplifier and type acceptance proposals, he wanted to take the opportunity "... to express my respect and admiration for the amateur community..."

Chairman Wiley also had some comments of interest in testimony before the House Appropriations Committee in Washington. The topic was the FCC's nearly 60 million dollar budget. Wiley, according to wire service reports, testified that the FCC will not attempt to institute a new fee schedule, because of a lack of accounting personnel necessary to meet the federal court order which struck down the original schedule. Documentation filed with the committee showed that the FCC has collected over $150 million in fees since 1970.

There isn't much left of Guglielmo Marconi's giant antenna system erected at the turn of the century on the dunes at South Wellfleet MA. There were originally twenty masts in a 200-foot circle on the sand dunes, but they blew down in a northeaster during November of 1901. Marconi replaced them with four 200-foot wooden towers. Today only two of the tower bases remain, the rest of the famous pioneer's station having been eaten by the erosion of the Atlantic. As reported earlier on these pages, the Town of Barnstable Radio Club will celebrate the 75th anniversary of Marconi's first transatlantic radio transmission. We've learned since that the US Postal Service is working on a commemorative stamp for the event, which runs multi-operator style from the South Wellfleet site between next January 14th and 22nd. The Barnstable Club still needs help with donations, and is offering a commemorative cachet envelope, 10 of which are available for a donation of $1.50, postpaid. Contact Robert J. Doherty W1GDB, RFD 1, 14 Pine St., Sandwich MA 02563.

A second phase III satellite for amateurs may be in the works for 1979. AMSAT president Perry Klein told *73* that NASA approached them early in March with a tentative proposal to allow one of the space shuttle flights to carry an AMSAT satellite. At press time, Klein said it was not a sure thing, but looked good. Asked if AMSAT had the capabilities for building a second phase III spacecraft, Klein replied that the goal of a new fundraising program just underway has been raised to $250,000 over the next three years, with $50,000 hoped for by the end of 1977.

Under the program, contributors can buy solar cells for the new satellites in multiples of $10.00. Each contributor will receive a certificate attesting to the fact. Each of the phase III satellites will carry approximately 2500 solar cells.

Both Oscar 6 and Oscar 7 continue to have their problems. Oscar 6, according to Klein, is "limping along," despite battery problems. Oscar 7 was reported to be jumping modes inexplicably early in March. Klein added that the mode jumping was taken care of by Canadian control station VE3SAT, the first completely microprocessor-controlled command station. It's hoped that all earth stations will eventually go to full computer control. Both phase III satellites will have micros onboard.

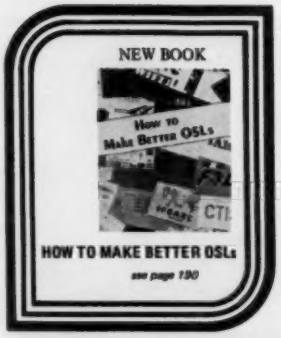
An FM repeater system aimed at keeping hunting and fishing parties in reliable radio contact with settlements up to 75 miles away is now being tried out in an Eskimo community in Quebec's arctic region.

Snowmobile portable rigs will work back to the repeater base station in the settlement of Koartac, about 300 miles north of Fort Chimo.

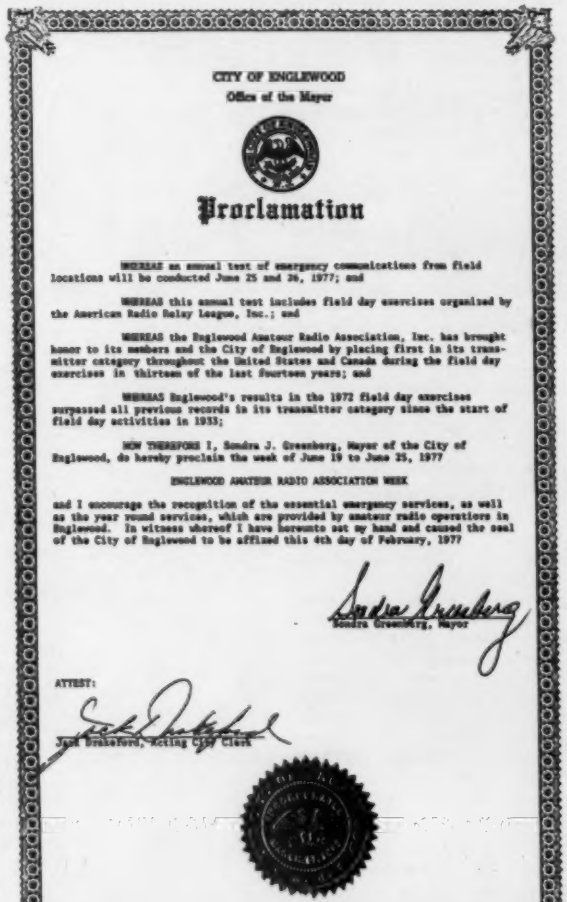
The original development work, complete with a phone patch, was tried out in the Ottawa area utilizing a 2 meter repeater set up by DOC's Communications Research Center in the hills north of the city. The station, VE2KPG, boasts an autopatch, and with the participation of local amateurs, provided development information for the prototype now being given field trials. The station has now reverted to amateur use. Thanks to the *Canadian Radio Amateur*.

In a trend that seems to be surfacing throughout the country, the theft of two-way radios from cars has been decreasing over the past few months. The Plano TX amateur radio club reports that in the Dallas area the theft rate dropped for the seventh month in a row. In January, 390 radios were ripped off, as compared to an average of 920 per month throughout most of 1976.

Sondra Greenberg, Mayor of Englewood NJ, has declared the week of June 19 to June 25 Englewood Amateur Radio Association Week, in honor of the city's amateur club. She cited the fact that recognition should be given to amateurs for their essential emergency services. The Englewood Amateur Radio Association has placed first in its category during 13 of the last 14 field days. In 1976, they were in a class by themselves (21A), chalking up a total of 10,186 points (with 2845 contacts).



Our English friends, who have been leagues ahead of us for years in the microwave ranges, have adopted a new callsign system for ATV and SSTV. A report in *CQ-TV*, published by the British Amateur Television Club, says that the Home Office has discontinued issuance of /T (television) licenses. Instead, existing amateur sound A and B licenses will be replaced with new ones, which will include both ATV and SSTV authorization.



CITY OF ENGLEWOOD
Office of the Mayor

Proclamation

WHEREAS an annual test of emergency communications from field locations will be conducted June 25 and 26, 1977; and

WHEREAS this annual test includes field day exercises organized by the American Radio Relay League, Inc.; and

WHEREAS the Englewood Amateur Radio Association, Inc. has brought honor to its members and the City of Englewood by placing first in its transmitter category throughout the United States and Canada during the field day exercises in thirteen of the last fourteen years; and

WHEREAS Englewood's results in the 1972 field day exercises surpassed all previous records in its transmitter category since the start of field day activities in 1933;

NOW THEREFORE I, Sondra J. Greenberg, Mayor of the City of Englewood, do hereby proclaim the week of June 19 to June 25, 1977

ENGLEWOOD AMATEUR RADIO ASSOCIATION WEEK

and I encourage the recognition of the essential emergency services, as well as the year round services, which are provided by amateur radio operators in Englewood. In witness whereof I have hereunto set my hand and caused the seal of the City of Englewood to be affixed this 4th day of February, 1977

Sondra Greenberg
Sondra Greenberg, Mayor

ATTEST:

Jean Brakeford, Acting City Clerk

A proclamation from the mayor of Englewood NJ honoring the accomplishments of the Englewood Amateur Radio Association.

Japanese amateurs working on the AMSAT A-O-D mode J transponder prototype. The ARRL will be responsible for all operations aspects of the satellite, which will be designated AMSAT-OSCAR 8 after launch late this year.

Officer Jay Webb of the Plano TX police and Marvin Arnold WB5BWW check out 5/8 wave 2m antenna during simulated emergency test that saw all police communications traffic switched to amateur frequencies.

Here are some details of the AMSAT-ARRL agreement on OSCAR 8, as reported in last month's "Briefs." According to the document signed by representatives of both groups, the ARRL will pay AMSAT $50,000 within two weeks after launch (the delay to allow a period of time to assess performance). ARRL General Manager Dick Baldwin's draft goes on to say, "Once in orbit, it is understood that both the ARRL and AMSAT will consider the spacecraft to be in the public domain without specific ownership." Baldwin's letter to AMSAT goes on to outline the League's intentions: "Our principal interest in this spacecraft is for providing continuing ten meter downlink signals for the OSCAR Education Program, and the performance of the spacecraft will be evaluated with this application in mind." The agreement calls for AMSAT to continue offering technical assistance on a no cost basis during the operational lifetime of the spacecraft. As we reported earlier, the ARRL, in addition to the $50,000 payment to AMSAT, will loan two staffers to work full time (at League expense) in Washington on the A-O-D project.

A word of caution about tubes and transistors using beryllium-oxide ceramics: While normal use is perfectly safe, the fumes and dust are highly toxic and can result in serious injury or death. Almost all ceramic power transistors use BeO, as well as Eimac 4CX250 tubes. Most are not labeled as containing the chemical. Never alter, grind, or clean any ceramic part of the tube that could generate dust or fumes. They should be returned to the manufacturer for disposal. Thanks to VE3AAC.

As mentioned in last month's "Briefs," part of the observance of Armed Forces Day will be the traditional military/amateur communications tests. Crossband operations will be conducted from 1300 UCT on May 21 to 0245 UCT on May 22. Military operators will transmit in their portions of the band and listen on amateur frequencies. The following is a list of frequencies that will be used. The left-hand column is the military frequency in kHz unless otherwise noted. The right-hand column is the appropriate amateur band in MHz.

NPL (Naval Communications Station, San Diego CA)

14.389 (1500Z-2100Z)	SSTV	14.225-14.250
7.370 (1500Z-2100Z)		7.16-7.19

NMH (Coast Guard Radio Station, Alexandria VA)

14.470	SSTV	14.225-14.250
7.346.5		7.16-7.19

WAR (Army Radio, Washington DC)

4001.5	CW	3.5-3.75
4020	LSB	3.775-4.0
4030	RTTY	3.65-3.775
6997.5	CW	7.0-7.15
14405	CW	14.0-14.2
20994	USB	21.25-21.45

NAM (Naval Communications Station, Norfolk VA)

3385	CW	3.5-3.75
4040	LSB	3.775-4.0
6970	LSB	7.15-7.3
7301	CW	7.0-7.05
14385	USB	14.2-14.35
14400	CW	14.0-14.1

NPG (Naval Communications Station, San Francisco CA)

4001.5	LSB	3.775-4.0
4005	CW	3.5-3.65
4010	CW	3.65-3.75
6980	CW	7.0-7.075
7301.5	LSB	7.15-7.3
7347.5	RTTY	7.0-7.1
7365	CW	7.075-7.150
13922.5	RTTY	14.0-14.15
14358	USB	14.2-14.275
14375	CW	14.0-14.1
14389	USB	14.275-14.35
20983	CW	21.0-21.2
20998.5	USB	21.27-21.4
49.995 MHz	AM/USB/CW	50.0-51.0
143.995 MHz	AM/USB/CW	144.0-146.0
148.40 MHz	FM/RTTY	146-148
148.95 MHz	FM/RTTY	148.0-148.0
222.0 MHz	AM/USB/CW	221.0-222.5

AIR (Air Force Radio, Washington DC)

4025	LSB	3.775-4.0
7306	LSB	7.15-7.3
7316	CW	7.0-7.3
14397	USB	14.2-14.35

The "CW" receiving test will be conducted at 25 words per minute for any person capable of copying International Morse Code. The "CW" broadcast will be a special Armed Forces Day message from the Secretary of Defense to all participants. A ten minute CQ call for tuning purposes will begin at 22/0300 GMT. The Secretary of Defense message will be transmitted precisely at 22/0310 GMT from the following stations on the frequencies listed.

WAR – Army	4030, 6997.5, 14405
NAM – Navy	3385, 7301, 14400
NPG – Navy	4005, 6989, 14375, 49.995 MHz, 143.995 MHz
AIR – Air Force	7315

The RTTY receiving test will be transmitted at 60 words per minute. A ten minute CQ call for tuning purposes will begin at 22/0335 GMT. The special Armed Forces Day message from the Secretary of Defense will be transmitted at 22/0345 GMT. Transmission will be from the following stations on frequencies listed.

WAR – Army	4030, 6997.5, 14405
NPG – Navy	4010, 7347.5, 13922.5, 148.410 MHz
AIR – Air Force	7315

Transcriptions should be submitted "as received." No attempt should be made to correct possible transmission errors.

Time, frequency, and callsign of the station copied, as well as the name, callsign (if any), and address, including zip code of the individual submitting the entry, must be indicated on the page containing the test. Each year a large number of acceptable copies are received with insufficient information, or the necessary information is attached to the transcription and was separated, thereby precluding the issuance of a certificate.

Entries should be postmarked no later than 25 May, 1977, and submitted to the respective service copied.

Stations copying NAM and NPG should send their entries to: Armed Forces Day Test, Chief, Navy-Marine Corps MARS, Building 17, 8th St. & So. Courthouse Rd., Arlington VA 22204.

Stations copying WAR should send their entries to: Armed Forces Day Test, Commander, United States Army, Communications Command, ATTN: CC-OPS-OM, Fort Huachuca AZ 85613.

Stations copying AIR should send their entries to: Armed Forces Day Test, Air Force Communications, Service/DOYF, Richard Gebaur Air Force Base MO 64030.

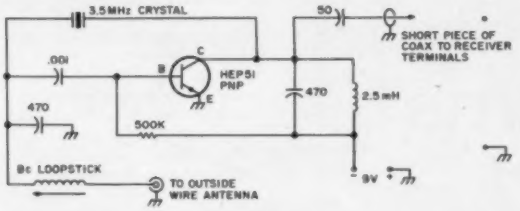
The Plano TX Police Department recently tested an emergency communications system provided by the Plano Amateur Radio Klub and Plano area amateur radio operators. All car-to-car and car-to-base communications were performed on the two meter amateur band. This exercise was a Civil Defense simulated emergency test to familiarize the police department personnel and amateur radio operators with operating techniques that might be utilized in the event of a natural disaster or failure of the police department radio equipment. Plano area amateur radio operators undergo regular training by the National Weather Service and provide weather watchers in the event of severe weather. During severe weather, the amateur radio operators provide a station at the police department, and the National Weather Service has direct contact with the amateurs. Frequently, the National Weather Service requests the amateurs to check storm cells in a particular area that look threatening on the weather radar. Thanks to W5FQA.

A County Circuit Court judge has ordered a temporary injunction against Trigger Electronics. The injunction, which bars any catalog mailings or magazine advertisements, is to be followed with a request for a permanent injunction, according to Assistant Illinois Attorney General John McPhee. Among the witnesses testifying against Trigger owner Irael Treger: an official of the Federal Trade Commission, six amateurs, and an SWL. The rub may come, however, when people who have ordered merchandise from Trigger and not received it, try to collect. The consumer fraud office at the Illinois AG's office

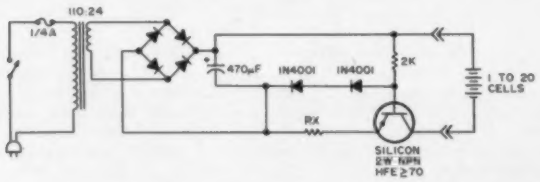
Continued on page 40

Circuits²

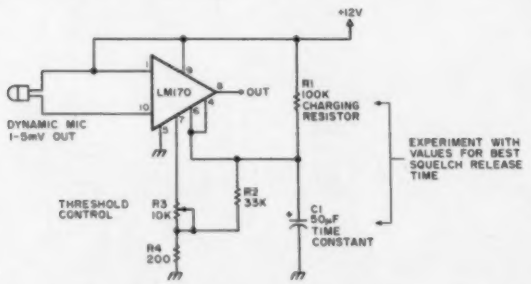
Want a free copy of any 73 publication? Sure you do. Just send in your favorite circuit, or even one that you don't especially like. If we print it, you take home the book of your choice. Just be sure to specify which book you want. OK?



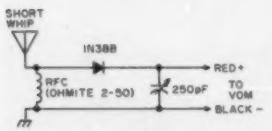
Here's a simple LF converter allowing coverage from 25 kHz up to 500 kHz. Be sure to use short coax from the converter to receiver antenna input. Here's how to use it: Tune receiver to 3.5 MHz, peak for loudest crystal calibrator signal. You are now tuning the 25 kHz range. As you tune your receiver higher in frequency to 3.6 MHz, you're tuning the 100 kHz range. 3.7 MHz puts you at 200 kHz, 3.8 MHz equals 300 kHz, 3.9 MHz yields 400 kHz, and 4.0 MHz gives you 500 kHz. Thanks to James Dates W2QLI.



A great way to keep those nicads at full charge. R_X = 0.6 volts divided by the desired current limit. We suggest 12 Ohms at R_X for 45 mA into 450 mA/hr AA cells. Thanks to Arvid Evans K7HKL.

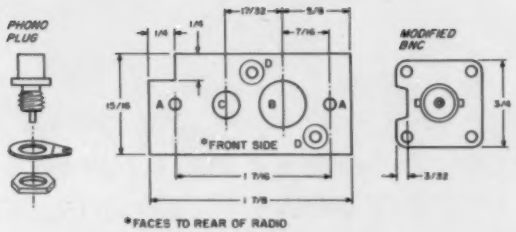


Wondering how to squelch out amplifier fan noise and assorted ham shack racket between sentences? This circuit will do all that, and make for more reliable VOX operation when a compressor is in use. Built as an addition to the IC compressor-expander circuit published in the January '77 73, the audio gate is placed in the early stages of the audio chain. It attenuates the audio path below a preset input level, and functions just like the squelch circuit on your 2m radio. Thanks to John Webber WA7ZMC.

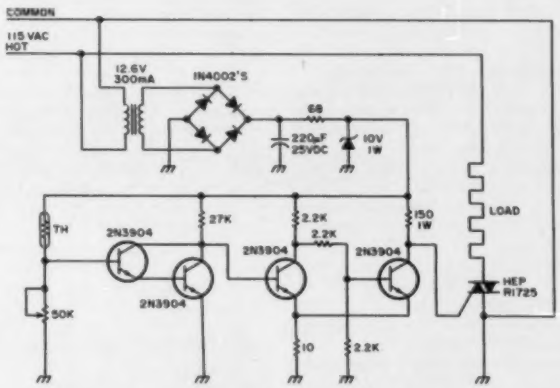


Ever wondered how to make a VOM do double duty as a field strength meter? Well, here's how to do it, with thanks to Dick Peters WA1PWF.

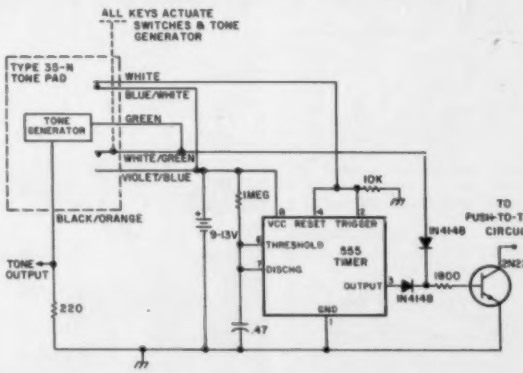
Here is a handy way to get -9 volts for your 1702A EPROMs from your regulated -12 volt power supply. Note: Each diode drops 0.6 volts (5 x 0.6 = 3.0 V). Diode type is 1N4004 (or equivalent). Current limited to 1 Amp through diodes. Thanks to Don Parks K4IJV.



If you're as fond of phono plug rf connectors as we are, you'll be interested in this mod for the Heath 2036 2m FM transceiver. To replace the phono plug with a BNC, first make the adapter illustrated above using 1/16" aluminum stock. Drill "A" holes with a #33 drill and tap them with 6-32 threads. Drill "B" hole 7/16" and "C" hole 1/4". Drill two "D" holes and countersink for 4-40 flat head screws. Then attach the phono plug to the adapter with the nut and ground lug on the rear side, at hole "C". (Note that it is advisable to use a washer on the front side for clearance at the PC board.) Now attach the modified BNC connector with the notch towards the phono plug nut. The flange is on the back of the adapter. Attach the adapter to the rear panel plate with the notch at the slide switch cutout using two 6-32 screws. It may be necessary to enlarge the oblong hole slightly. Drill a round hole in the antenna connection pad on the power amplifier PC board, just large enough to accept the BNC pin. Now assemble in a manner described in the Heath manual, starting on page 103. (Be careful to pay attention to the tightening and strain warnings.) Thanks to Bill Chedeville W3GOD.



Believe it or not, this circuit was originally designed to control the temperature of water in a slow cooker at the ideal level to make yogurt! The temperature controller uses a model K600A thermistor available from Allied Electronics. The potentiometer value can be changed to allow triggering of the circuit at proper temperature. A polarized power plug should be used for proper circuit operation. Thanks to Jim Arner, Jacksonville FL.



Here is a way to end the autopatch-while-in-motion blues. The circuit operates your rig's push-to-talk whenever any touchtone pad button is pushed, thus ending the need to engage mike before dialing. The circuit remains active for about 2 seconds after the button is released. Thanks to Harry Ketler W1DGD.

BE MY GUEST

visiting views from around the globe

Hank's Dilemma

His name is Alfred "Hank" Greenberg W2LTP. Greenberg is a retired deputy sheriff in Cranford NJ, and he's up to his ears in legal trouble over his antenna farm. Greenberg says he's the victim of political shenanigans, and his antenna fight is bound to affect similar cases in New Jersey, and possibly across the country.

More than 30 years a licensed amateur, Greenberg is considering a mortgage on his house to finance his appeal of a $2000 fine brought by a municipal court judge earlier this year. At issue is the classic question of an amateur's right to erect antennas.

Greenberg's troubles began last September, when a neighbor complained his four 55' telephone poles were an eyesore. That brought down the local building inspector, who promptly filed a complaint charging Greenberg with violating the local building code. Greenberg erected the poles during the summer of 1975, hoping to stack beams on them to supplement his Christmas tree array on a frontyard tower. Four poles were put in, two in his side yard, and two in the rear. Two of the poles aren't even in Cranford, because the Kenilworth town line runs through his property.

The Cranford building inspector told Greenberg the issue wasn't TVI. Instead, the town was wondering why he hadn't applied for a building permit before erecting a structure over 16 feet high. Greenberg contends that no one has ever had to obtain a permit in Cranford for antenna towers before and he points to much higher antenna supports in the commercial district, including the town's own fire station, public works building, and first aid squad headquarters. All are higher than Greenberg's telephone poles, and he contends that the others never even asked for permits. In one case, the town actually sent people over to direct traffic while the tower was being put up. Greenberg then asked the town if it wasn't violating its own ordinances. That approach got nowhere, and Greenberg's lawyer, Elson Kendall W2INL, advised that it was time to go to court.

On December 8th of last year, Hank Greenberg was convicted of violating the Cranford zoning ordinance and fined $2000. What's more, Greenberg was ordered to pay $200 a day for each day the phone poles remained in the air after January 15th. Sixty amateurs turned out for the court case, all prepared to testify on Greenberg's behalf, but Judge Charles J. Stevens would not let them testify, ruling that no further testimony was necessary. Defense witnesses who did get to take the stand included Dr. Jerry Sevick, a physicist and antenna expert with Bell Labs, and Dr. James M. O'Kane, a sociologist at Drew University. Dr. O'Kane testified on the social value of the volunteer services performed by amateurs, and his testimony would, months later, be underscored by an emergency at sea.

The decision was quickly made to appeal Judge Stevens' ruling, and as this issue goes to press, Hank Greenberg says he's determined to win. Greenberg is so committed to his cause that he's planning to mortgage his house, if necessary, to continue the fight. In the interim, Kenilworth town officials moved to bring charges of their own on the poles within their borders.

While he waited for the appeal to come up in county court, Greenberg's case began to attract more and more attention in the local media. Front page stories in the *Elizabeth Journal* and *Daily Journal* soon brought a flood of letters to the editor. Most supported Greenberg. Wrote Irene Kowalski of Elizabeth, "This is a sad state of affairs when a retired man has to mortgage his home in order to defend himself against attacks by officials. People who attended his trial have told me that everything he, his attorney, or witnesses had to say was objected to . . ." Wrote Jim Dembeck of Elizabeth, ". . . It seems to me that the question boils down to this: Is one man's hobby, for fun, justified, when it has an adverse effect upon his immediate neighbors? . . ." And Lorraine Bardack of Roselle Park wrote, ". . . One man who lives behind Mr. Greenberg told him that he could put his antenna on his garage . . . I know of the fine work Mr. Greenberg has done . . ." And so it went, until February 18th — when Hank Greenberg's "unsightly" telephone poles helped save nine lives.

According to Greenberg, it was a pretty normal Friday night at W2LTP. "It was about 4:30 am and I was working KH6FC on 40m SSB," Hank told *73* in an interview. "All of a sudden I heard this super-weak signal on frequency calling 'break — Mayday, Mayday — this is W3' . . . but I couldn't get the rest." Several tries later, Greenberg had copied W3LBU maritime mobile, but getting the rest of the frantic call wasn't easy. Minutes passed and the pieces began to fit together — it was a distress call from a

The QTH of Hank Greenberg W2LTP. His property happens to lie in two towns, both of which are trying to force him to remove the telephone poles.

RETRACTION

It was stated in the newspages last month that Robert Booth W3PS not only is the General Counsel of the American Radio Relay League (ARRL), a nationwide organization of amateur radio operators, but also represents the National Association of Broadcasters (NAB) and, therefore, does not and cannot adequately represent the ARRL. That statement was incorrect. Although Mr. Booth and his law firm, Booth and Freret, do represent AM, FM, and TV broadcast stations before the FCC, we know of no instance in which such representation has limited or conflicted with his representation of the ARRL and amateur radio before the FCC, Congress, or elsewhere. We offer our apologies.

vessel somewhere in the Caribbean. The bilges were flooded, and the ship's pumps were not working. W2LTP, with the help of those "unsightly" antennas, kept W3LBU transmitting and called the Coast Guard in New York. They called New Orleans and Galveston and the FCC. Direction-finding put the troubled craft (named the *Explorer*) between Cuba and Jamaica. Five hours later, a Coast Guard plane out of St. Petersburg FL dropped portable pumps to the *Explorer*, and the twin-masted 180-foot sailing vessel and her crew of 9 were saved.

Hank Greenberg speaks of the rescue matter-of-factly. He's got other things on his mind these days . . . like how he's going to pay the $5000 worth of legal expenses his lawyer estimates the case will end up costing. The appeals process was just getting underway as we went to press, and Greenberg says he's confident of a reversal. We'll follow up on W2LTP's ordeal later, but in the meanwhile, there is a contributions drive underway to help out with the legal bills. Send them to Amateur Radio Legal Defense Fund for the Benefit of Hank Greenberg W2LTP (ARLDF/W2LTP), Midlantic National Bank/Raritan Valley, PO Box 996, Edison NJ 08817, Attention – Mr. S. J. Lieberman WA2FXB.

Greenberg's attorney told *73* at deadline that as the appeal case opened in Union County Court, the judge overruled the lower court, ordering subpoenas re-issued for defense witnesses. (Municipal Judge Stevens had denied them on a technicality at the lower court level.) In the view of Greenberg's lawyer, that means Hank will finally get his chance to present his defense. Among the records Attorney Kendall has subpoenaed: the Cranford building inspector's files on permits.

Warren Elly WA1GUD
Assistant Editor

73

...tell us you love us

see page 189

Over a Barrel

Summer vacation time is almost upon us again, and it's probably a good idea to start planning that annual trek. In that same vein, we present one ham's letter home during last summer's vacation . . . a letter delayed, undoubtedly, by the Pony Express. – Ed.

Dear Mort:

Harriet and I made it OK. The trip was nearly perfect. The car ran fine all the way to Paris, but I had a little trouble there. It all started when I noticed we had stopped, and I had done nothing to stop us. Oh, don't be too worried, because we didn't stop fast. We just sort of coasted. I was talking to a fella near there on the rig, and next thing you know, the whole car was screaming at me to do something. Homer jumped into the front seat sort of suddenly, and sat on my Atlas. I couldn't see where I was. I was lost. For all I know I could have been on 80 meters and all of a sudden causing QRM or something. I hit him with my logbook. It was a good hit, it was, right on his wet nose. I think I scared him, 'cause in all the confusion Homer ran away. Harriet started crying, and the kids kept screaming something about my antenna . . . and their model airplane . . . they wanted us to go fast again so their plane would fly some more. I tell you, Mort, I almost lost it right there by the Walkers' mailbox.

Well, Mort . . . I see we've been a little deregulated again by Washington. Boy, when I heard about it I was furious . . . really mad! Just think! I shouted to myself, no more comedy when I forget what call area I'm in, no more DX on the 2 meter rig until you ask the guy where he is . . . no more . . . and then it hit me!

Ya know, Mort . . . the FCC doesn't *make* us call CQ . . . we just sort of do it. Fact is, the FCC doesn't make us hams do a lot of the things we do. We do them 'cause they're fun. Like RST and QTH. We don't have to do that; if someone really wants to know where we are, they could look us up . . . but all the hams do those things 'cause they're part of the fun we have on the ham. Radio, I mean, ya know?

I gotta admit, it took me a time or two to make sense out of all this, but I think I'm doin' it. The FCC sort of trusts us, in one sense . . . probably cause they're over a barrel over not having enough people or money or something like that . . . why, when a government agency suddenly gets real popular, all that red tape, budget approvals, and the like could take years.

Think of the tons of paperwork this whole thing is gonna save 'em. Maybe they'll take some of the money they save, and send someone after that terrible noise I've been hearing all over 40 meters.

Seems like there's something in Part 97 about improving amateur radio (oops, I missed that one, didn't I Mort?) . . . something in there anyway about improving amateur radio thru rules that make us sharpen our skills, and advance the communications thing. Maybe that goes for relaxing rules, too.

More I think about it . . . more I think I'm gonna make "mobile," "portable," 5, 6, 7, KL7, or lost . . . a part of my every transmission . . . just like always, and show them that we don't need all that paperwork to make good hams out of us.

Whaddya think, Mort? . . . think it's a good idea?

73,
Woody

P.S. The family don't like Mauve, Tex., too much. We're gonna keep going.

Reprinted from the bulletin of the Plano Amateur Radio Klub, Plano TX.

The CB Debate

With WARC, repeater deregulation, instant upgrade, linear amplifier bans, and type acceptance of amateur equipment all bottling up our perspective on where ham radio is going, it might be time to think again about CB. Here's one man's perspective . . . but the editorial door is wide open for more. What's your reaction to WB4APC's ideas? – Ed.

All too often, we refer to the CBer as an undesirable amongst us. Many an old-timer, myself included, can remember when it was unthinkable to be seen talking to a CBer. For many years, both the ham and the CB operator have gone their separate ways, each enjoying his own hobby. Whether we like it or not, CB radio is here to stay, and it is time to take a look at what each has to offer the other. Most of us are familiar with the advancements being made in communications. True, hams have made the most contributions to the state of the art, but we also are able to find a wide variety of people using Citizens Band radio.

Many a CB operator has an interest in amateur radio but does not have the opportunity to really get to know and see what amateur radio is all about. For example, I live in a small town close to a large military installation. I have had amateur call plates on my car for four years now, and have yet to meet more than two other hams in my area. Having recently started a small business, I found the need for a two-way radio that would enable me to keep in contact with my office and also allow my customers to contact me with their questions or problems. I bought a CB radio and applied for and got my FCC license.

Then I started to meet and get to know the average CB operator. Through my day by day association with them, I found that the majority of them are very sincere in their use of the radio. I also learned of the real dedication of the CBers in wanting to help others, no matter how small or large the need.

In the area where I live, CBers have set up 24-hour coffee breaks along major interstate highways. They offer free coffee and donuts, and a chance to stop and rest on a long drive. They also have mobile units patrolling the interstates, working with CB radio-equipped State Police cars and wreckers, to offer assistance to stranded motorists. Their action puts many a stalled car back on the road home, or gets them out of the traffic lane, thereby removing a possible traffic hazard. During last Memorial day alone, there was not one accident on the interstate between Louisville and Bowling Green, Kentucky.

In addition to the coffee breaks, during the tornado of 1974 in Brandenburg, Kentucky, CB operators were working around the clock to assist the local police and fire departments, and even used their personal cars for ambulances. At the end of the three day disaster, we knew exactly how many people were lost or missing.

How wonderful it would be if we could get amateurs and CBers working as a team, to coordinate the emergency operations and eliminate dupli-

cation of effort. With CB units furnishing the "eyes" and helping to perform traffic control and person counts, and the amateur-CB station acting as a sort of control-coordinator station, we would have an unbelievable system of radio communications. Imagine the capabilities of the well-equipped ham station, with CW/SSB and RTTY capabilities. Almost any type of emergency assistance could be well on its way in a matter of minutes.

In addition, the amateur station, with phone patch capabilities, could contact Red Cross officials, the governor, and other officials directly. In this manner, help could be sent when and where it is needed the most.

With the use of SSTV, facsimile, and video tape systems, actual pictures could be transmitted to the proper officials, showing them conditions as they really exist. Can you imagine the effect of such a system, not only within your own state, but on a nationwide basis? Who knows what may develop? With the ARRL (ugh) talking about a Communicator license, and the FCC looking for more CB frequencies, maybe someday a common frequency will be allocated where hams and CBers may talk to each other. The potential is unlimited, and in this modern age of computers, even a list of standby emergency stations and their capabilities could be maintained. In addition, a list of emergency supplies, alternate emergency routes, and up-to-date status reports would be only a button away. Let us remember, that as amateurs, there are many avenues of research and system development still open to those that are unafraid to try. We can make it work!

Billy L. Nielsen WB4APC
Radcliff KY

Knighthood

Amateur radio operator David Urfer EL5B/WA7ROJ had the honorary title of Knight Official in the Humane Order of African Redemption bestowed upon him for his role in aiding the Liberian government in bringing the 1972 Lassa fever epidemic under control. The presentation was made by the Liberian Minister of Health and Welfare, on behalf of President Tolbert of Liberia.

Dave received the knighthood because he had stayed at his amateur radio station for over 86 consecutive hours, coordinating communications between the health authorities in Zorzor and Monrovia, Liberia, and the United States. He had been a ham for less than one year, and was a maintenance supervisor for a Lutheran hospital located in Zorzor (a remote section of Liberia).

Lassa fever is named after the town in Nigeria where the first case was isolated. It is highly contagious, like cholera, and the dead are buried hurriedly.

All traffic on 20 meters, during the crisis, was coordinated between Dave EL5B, Eloise Duncan EL2AQ, Walcott Benjamin EL2BA, Bruce Adams EL2CG, Dr. Gadegbeku of the Zorzor hospital staff, and Charlie Wells, Jr. K4SKI, located in the U.S.

The date that called these ham radio operators into action was April 12, 1972 — Easter. Dave was on the African net on 14.292 MHz around 2130 GMT, with Walcott and the other hams living in that part of the region. During the casual round table, Dave mentioned that there was an outbreak of some sort going on in Zorzor, and that the doctors, Paul Merten and Joe Baum, were not sure of what it was.

A letter had been mailed, but the radio proved to be timesaving when EL2BA made a phone call to the Minister of Health and Welfare to notify her of what was happening.

After the authorities were notified, doctors and specialists were brought in from the capital of Liberia, Monrovia.

Charlie K4SKI had maintained an on-the-air relationship with those involved with the emergency, and he broke in to see if he could help. Dave mentioned that he and other members of the hospital unit wanted to let their friends and relatives in the United States know what was happening. Dave then started running phone patches through Charlie, who was located in Greenville, North Carolina.

K4SKI's log showed the following chronology of the traffic he ran for the hams in Liberia for the next 5 days:

April 2, at 2150 GMT, I ran 3 phone patches over 20 meters to relations in the U.S. to let them know what was happening in Zorzor. April 4, EL2CI, Doc (Dr. Gadegbeku) and EL2CG (Bruce) were on 20 meters talking about the epidemic. On April 5, Bruce had me run patches to the Communicable Disease Center in Atlanta, Georgia. These patches were run between doctors in Zorzor and doctors at the Atlanta center. They lasted 2½ hours. The next day, similar patches were run between the doctors in both countries. I was told that the Communicable Disease Center in Atlanta had a ham station (WB4GFE) and that they would try to have it on the air on 15 meters for us the next day. April 7, I looked for WB4GFE on 15 meters at 1710 GMT, and barely could make them out. KP4DLW joined in to help with a relay between us. Realizing that it was a cumbersome situation, I told the disease center that we would run patches with them via 20 meters.

The Lassa fever episode struck nine people in Zorzor and killed four of them. Of the survivors, two became deaf.

One of those who died was an American nurse, Miss Esther Bacon of Hawarden, Iowa. She had given 30 years and her life for humanity.

Dave Urfer became a knight not solely because of his own action, but because of the responses of several amateur radio operators who spanned two continents.

Lawrence I. Cotariu WA9MZS
Skokie IL

Mrs. Mai Padmore, Liberian Minister of Health and Welfare, decorates David Urfer EL5B during ceremonies in Monrovia, Liberia.

Join 'em!

More times than I'd care to count, amateur friends have remarked to me, "Your husband is so lucky to have you share an interest in our hobby," or, "I wish my wife could meet you so that you could tell her about ham radio and get her interested," or "How can I get my wife interested in ham radio — how did you get into it?" So, I thought I'd make an attempt to answer these questions in a way that can be helpful to those wives whose husbands would like their company!

Ham radio is a relaxing hobby to most people. Your man comes home and settles down in front of his radio and unwinds in a variety of ways — by telling somebody about the frustrations of the day, how lousy the Massachusetts drivers are, how bad the traffic was, etc. Or he finds some excitement in chasing some rather rare station halfway across the world, while his wife is wrestling with the pots and pans upstairs. At any rate, for numerous reasons, he enjoys the hobby. Perhaps he enjoys it so much that you find it difficult to tear him away long enough to get his attention. Aha! When various diversions fail to work, you can always adhere to the old adage, "If you can't lick 'em, join 'em."

All kidding aside, if you think about it, our life-styles seem to separate families a lot more than they should for the health of the family. Everybody is so busy doing his own thing that we lose sight of the most important aspect of life — our re-

lationships with those we love. In my view, anything that a woman can do to increase the amount of time shared with her husband is bound to improve their relationship. This doesn't have to be a great deal of time, but the knowledge that you care enough to make the effort can mean a lot. Nobody expects you to be an expert on subjects electronic. I pretend to no one that I am interested in the technical side of the hobby, though I've absorbed enough to have a very basic understanding.

Is it hard to pass the licensing exam? If you managed to learn to drive, you can do the same with ham radio. However, it *is* easier if you attend a class with competent instructors, rather than trying to muddle through the license manual on your own. Learning the code is simply a matter of concentration and determination. It doesn't take any great genius.

Besides improving family solidarity, I've made an awful lot of friends and met many people that I would never have met without ham radio. And ham radio is probably the most democratic hobby I know of. You are judged by the signal you put on the air and by your manners, not by how much money you have or have spent on equipment, not by your job or by your education. After listening to several hundred people going back and forth to work on a daily basis, it crosses most people's minds (or I hope it does) that they are just like you in the place where it counts, with all the externals that we like to put up around ourselves stripped away by the limitations of the airwaves.

My children have become involved in the hobby because they see the enjoyment their parents get from it. We have all come to depend on 2 meter FM as an adjunct to the phone and other modes of communications in keeping us in touch with each other and as an aid in times of emergency. Having a ham radio license has very practical advantages, as I have discovered on several occasions when my car broke down. I had help each time within minutes, and this is very comforting when you are at the mercy of an unpredictable machine.

For whatever reason you find most appealing, amateur radio is a hobby well worth the effort to become a part of, and which you can pick up at any time and *enjoy*.

Cindy Rudin WA1MZO
Lexington MA

GOLDEN ROAD KIT

ALL YOU NEED TO BECOME A HAM

see page 196

Reprinted from The Minuteman, *Newsletter of the Minuteman Repeater Association, Lexington MA.*

Applying ATV

The technology to economically apply interactive television to educational purposes is here. It is based on the techniques being utilized in amateur television – ATV for short. Amateur television is an upgraded offshoot of ham radio, using a television transmitter, a TV camera, and a regular TV set with a special converter attachment. It allows an operator to broadcast a television picture and voice to another ATV operator. Through the use of a repeater on UHF frequency, it is possible for schools and other educational institutions to apply this technology – within a 15 to 150 mile radius – for educational purposes. The potentials are endless, ranging from use in traditional classroom activity to continuing and extension education. It can be used for homebound instruction, for seminars among experts at different universities in New York and as far away as Philadelphia, for a variety of community services (including linking a classroom with other segments of the community), and to provide educational services when severe weather and fuel shortages force school closings.

In order to insure that in the public interest certain frequencies within the UHF channels be allotted specifically to educational purposes, the City University of New York Graduate School, through its Center for Advanced Study in Education, and the nonprofit Communicasting Association of America, has filed a petition (1/21/77) with the Federal Communications Commission for the establishment of a new educational radio service, to be known as "communicasting" – i.e., the use of co-channel multi-lateral communication to educate and enlighten the participants as well as a listening/viewing audience. The use of radio repeaters, whose value has been proven in the land mobile and amateur radio services, is cited as the most cost-effective way to blanket an urban, suburban, or rural area with audio and television signals. Spectrum space is being requested in the 470 and 930 MHz range with preference being given to the use of television channels 70 through 83 (806-890 MHz).

The Graduate School's Center for Advanced Study in Education, through its Institute for Research and Development in Occupational Education (IRDOE), is currently engaged in pilot research and development activities surrounding curriculum development and delivery systems, evaluation of protocol approaches as they would apply to airborne transmission, protocols for interaction in multiple-station situations, and assessment of delivery ranges over various terrains and distances via both direct and repeater transmissions. It is anticipated that this research will have a direct bearing upon initial efforts to demonstrate airborne delivery systems for educational purposes in New York State.

Dr. Lee Cohen, Director of IRDOE, believes that the utilization of new technology is imperative if education is to remain viable in the current and future economic and social climate. "In addition to the ability to deliver education in a more cost-effective manner, we have the potential to serve additional populations not heretofore served and to provide lifelong learning opportunities to those who cannot avail themselves of the traditional classroom learning opportunities. We are on the cutting edge of something we cannot totally envision as yet, since application of the technology is only limited by educators' imagination and inventiveness." Interactive television, he quickly adds, "is not the one-way broadcast TV we've come to know, which limits learning to the lecture mode. Given the same considerations as have been provided to the Citizens Radio Service, for example, educational agencies properly licensed could experiment with the delivery of quality education, health, and social information, and enable viewers to question, challenge, and even present their accomplishments for grading purposes over the airwaves. For the FCC to deny education on these frequencies and, at the same time, expand non-essential mobile and fixed station operations, is to reject the populace in favor of the few."

City University of NY
New York NY

The Key

In the world of business and industry, there's an adage which states that when your boss asks you to give up your key to the executive men's room, you're in deep trouble.

Looking closely at the recent decisions by the FCC affecting the amateur radio service, I can't help but wonder if we hams aren't being asked to turn over our keys. And, if so, just how much trouble are we in?

It's called "deregulation," and over the past few years it has meant the elimination of log books, the closing of many official monitoring stations, the abolition of the requirement to identify portable and mobile operations, and so forth. To be certain, they are all seemingly small things, but hidden among them may lurk a more sinister meaning.

On the surface at least, the FCC has said that since we're doing such a great job of policing and regulating ourselves, there's no need for government to become involved. This is great; I'm for less government. But in light of the bucket of worms in which the FCC finds itself as a result of the snowballing CB service, I can't help but be a little skeptical about the FCC's rationale.

Over the years, the history of amateur radio has been one of compliance with regulations and courtesy in operation. They have become our hallmarks. In short, we have been a most disciplined group. Discipline can be effected in one of two ways: First, we do something because we know an enforcer is looking over our shoulders. Or second, we act for the common good. The latter is certainly the ideal situation, but, alas, it is also the more utopian of the two. Thus we're left with the first type of motivation.

In the 1920s, the early days of radio, chaos reigned supreme. A regulatory agency was desired and necessary. It was created, and with supervision, guidance, and enforcement came order – law and order, if you will, as opposed to the law of the jungle. We learned that according to a regulation, something had to be done in a certain manner, and then we came to appreciate the need for doing it just that way in the first place. One notion complemented the other. And most of us grew up in amateur radio with this concept. Take away the concept and the prospects are frightening.

Amateur radio is growing. It is not growing perhaps quite as rapidly or as extensively as some may envision, but it is growing nevertheless. If new members join our group who have never been exposed to the tight discipline under which we've operated all these years, how will they behave? How can they be expected to behave? They will probably act in much the

same fashion as the spoiled child who wants something done his way at the particular time he wants it, knowing full well that the threat of a spanking doesn't exist because there is no one there to administer the punishment.

Personally, I have always felt that there should only be just enough federal government to insure that the things which have to be done in a democracy get done. The FCC's abdication of its role in the amateur service can, over the long run, pose a very real threat to the existence of amateur radio itself. Consider another adage: "Out of sight, out of mind." I doubt whether we as a group are sufficiently strong enough to (a) police ourselves entirely, (b) look out for our interests in international frequency allocation conferences, and (c) protect ourselves against the interests of powerful electronics manufacturers' lobbies when they threaten us.

In short, we still need the FCC. If deregulation is coming about because amateur radio has in fact matured to the point where strict supervision and guidance are no longer necessary, then it should be continued on a slow basis and explained very thoroughly. On the other hand, if deregulation is only an excuse for the FCC's inability to govern all the radio services within its purview, then we are in deep trouble indeed.

Hopefully, in future decisions affecting the amateur service, the FCC will act judiciously and cautiously, and certainly not give the appearance of the boss coming into your office and asking for your key.

Daniel T. Davis W8LUX
South Bend IN

The Posse

There has been much discussion on these pages in recent months about the "HFers" and the consequences of the RFI/TVI problem. (See "The Ban Moves Closer" and "C'mone Texas Salt Rat . . ." in April and March 73, respectively.) There is, like any other issue, another side to the story. So, in the same vein as "CB Can Do Some Things Better" in our March issue, here is more testimony to the usefulness of Citizens Band. — Ed.

Capt. Gerald S. Arenberg, CB Posse Training Officer, is shown at the monitor at the National Headquarters.

With some twenty million Citizens Band radios, the "eyes and ears" of local police are driving criminals off the streets and into jail. Drunk drivers are being spotted and reckless drivers are being reported to "Smokey the Bear" by the Citizens Band operators. Why? The answer, claims Chief of Police Robert Ferguson, president of the National CB Radio Posse, is very simple. "We monitor emergency channel 9 like many police, sheriffs, and state patrols. People are tired of the drunks that are running up auto insurance bills, the reckless driver who may kill or maim your friends or mine. 'Smokey' is now as close as your CB radio and you can get help quickly. With CB you don't get involved. You report what you see and the police act on your information."

The National CB Radio Posse was the brainchild of Chief Ferguson, whose department is located at a major crossroad near Akron, Ohio, in Bath Township. "There are not enough police to cover every street and highway. So a lot of good people feel it's time they made the streets safe again. They are reporting crimes as they happen. We are able to send aid to motorists quickly because of reports by CB radio to our station. Lives are being saved. Criminals are being caught and jailed, all because a man or woman picks up the 'mike' and calls on the emergency channel (9). The CB Posse got started because some CBers wanted to do a bit more by organizing into community radio patrols. We encouraged this because we and thousands of other police and sheriff's departments can use trained eyes and ears.

"In our case, we designed an emblem to wear, a metal shield, car tag, and asked for volunteers throughout the nation to carry first aid kits, flares, warning flags, a flashlight, and other equipment. These are items that everyone should carry as a safety rule, anyway. The CB Posse member is not a police officer. His or her role is to use the radio, patrol, and aid a motorist or request aid be sent. In one southern city, 1900 calls were logged in one month, resulting in the arrest of a rapist, a burglar, a number of armed robbers, a murderer, and many rescue missions to distressed motorists.

"Like the Marines, the National CB Radio Posse is looking for a few good men and women who want to help via radio as unpaid eyes and ears for their own community police. Our program is a national one. We have chapters springing up in many parts of the nation. We have chartered the National CB Posse as a nonprofit fraternal organization with modest dues for benefits and services provided members — everything from a special ID card and emblem to a death benefit if a member is killed while assisting any police officer or fire fighter."

American Federation of Police
N. Miami FL

News? We need input, and one of the best sources is the club newsletter. Got one? We reiterate our longstanding offer of a free subscription to 73 *or* Kilobaud *in exchange for a spot on your ham or computer club newsletter mailing list. Deal?*

Hamming/G5

If you want to "ham it up" in England when visiting, "plan ahead" to take advantage of the reciprocal licensing procedure available. Remember, there is nothing to listen to on what we most popularly use: 146 MHz. It takes a little time to get it (license), so start early and surely allow more than a month. Airmail your request to: Home Office, Radio Regulatory Department, Radio Regulatory Division, Licensing Branch (Amateur and Special), Waterloo Bridge House, Waterloo Road, London, SW1 8UA, England.

There are eight different classes of licenses available. Four are for fixed stations, four are for mobile stations.

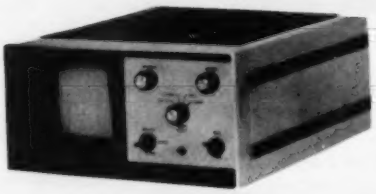
Most commonly, a reciprocal license is granted for six months. After expiration, the callsign is reserved for your use for any UK license granted you in the future. Some of the regs are quite different — no other person may speak over your rig, no third party traffic, no code speed over 20 wpm—and no equipment capable of transmitting on CB frequencies (similar to ours) can be taken into the country without advance permission.

As noted before, frequency allocation is different — their two meter band is from 144 to 146, with 11 specific frequencies between 144 and 145 that *must* be avoided. 150 Watts is the maximum input power. FM is between 145 and 146.

A copy of your license must be enclosed with your application for the British license; don't send any money until you are advised of your application being accepted — at that time they'll tell you what to send. In December, 1976, the fee for a fixed station license was about $10; for a mobile station license it was $5. You can buy British currency at a large bank and send it, saving the cost of international money orders ($3 or more).

Continued on page 78

Start your slow-scan TV with a



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New Products

THE HEATH HW-101 TRANSCEIVER

With all the growth we've been seeing in the amateur ranks, we thought it might be time to look over some of the less expensive ways to get on the air. Outside of home brewing a transmitter from a battered old TV set and using a bargain basement receiver (as many of us did years ago), we thought we'd examine some middle ground — the kit transceiver. The choices are pretty narrow, especially when economy is the major concern, so here's what the editors have come up with — the Heath HW-101. As our reviewer points out, the HW-101 has been around long enough, and enough hams have been using it satisfactorily, to put the Heath well up the ladder on anybody's list of choices. Having used HW-101s of various vintages in situations from field day to emergency operations, we can testify to the transceiver's reliability and simplicity. — Ed.

The HW-101 is by far the best buy for the ham who wants a five band SSB and CW transceiver. With 180 Watts input and 125 Watts output on 75 and 40 meters, and 90 Watts out on the higher frequencies, the Heath is perfect for the seasoned amateur or a Novice or Technician with hopes of upgrading to a higher class license. I decided on the HW-101, after a long absence from "the low bands," because of economy (list price is $339.00 plus ac supply) and reliability. There are thousands of these rigs operating all over the world.

From date of order, it only took 10 days for the kit to arrive. I was pleasantly surprised to see my new Heath come in such a compact carton. Those Heath engineers must spend countless hours planning every last detail. Heathkits (for those of you who have never built one) use an ingenious system of subpacks. Gone are the days of a kit being just instructions and a carton full of miscellaneous parts. (The HW-101 had 10 subpacks.) During the process of building the kit, a subpack is called for as it is needed. I'll bet this has saved many a call to Benton Harbor from frantic kit builders who have almost completed their projects only to find a diode or transistor has been sucked up by the XYL's vacuum cleaner or eaten by the family Labrador retriever. Essentially, what this system does is provide only the parts necessary for the phase of construction on the bench at the time. No sorting through muffin pans full of parts.

After opening the carton (and looking at the empty Heath green cabinet and dreaming of DX on 20m), I saw that the hams at Heath had sent me a little note explaining that they had received a bad batch of 6HS6 tubes. They enclosed 6AU6s as substitutes, and all I had to do was fill in my name and address on a postcard they enclosed, so the proper tubes could be shipped as soon as Heath received them from the manufacturer. The tubes had not arrived as of this writing, but the 6AU6s work just great, with just slightly reduced receiver sensitivity.

The 200+ page manual is well illustrated and easy to follow. It includes chassis layouts, voltage and resistance charts, x-ray views, and schematics. In addition to the troubleshooting charts, the manual has many foldouts that give parts locations for construction. After reading through the manual, I started putting my new radio together. The first steps Heath outlines are the installation of parts on the switching boards. These are special circuit boards with built-in wafer switches to help eliminate intricate switch wiring. This is a good place to start since the components are not spaced extremely close together. That kind of a start gives the first-time kit builder a good chance to check out his soldering paraphernalia. I was somewhat surprised to see that Heath did not use glass-epoxy circuit boards. But, judging from the number of HW-101s on the air, I would venture to say that the composition of their boards is more than adequate. What could have been a very tedious part of the construction was already done for me at the Heath plant, namely, the construction of the wiring harness. This harness contains all the necessary wires and cables that run between the circuit boards. It certainly was nice having those multicolor coded wires neatly arranged and prepared. It really saved me quite a few headaches.

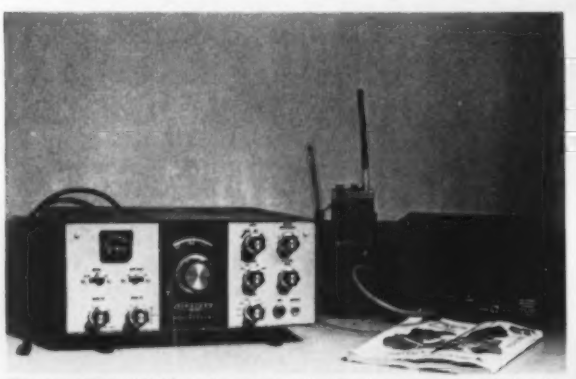
The kit went together amazingly well, although it is not advisable to spend really long stints at the work bench doing such precise work. I found that evenings after dinner I could work for a couple of hours without experiencing too much lower back pain. One evening I worked on the HW-101 for over six hours, with only one fifteen minute break. This is when the only wiring error that I made occurred. But, it was avoidable. If I hadn't been in such an all-fired rush to get the rig completed and on the air, it probably would not have happened. A slight amount of patience is a virtue when constructing anything, be it a home brew keyer or a model airplane. My only words of advice are, when you're building a kit and your body tells you it's time for a break, listen to it and take one! Heath's manuals are so well thought out that you can stop virtually anywhere during construction, and have no problems at all picking up where you left off. A couple of times during construction, I had to run off to emergencies (I am a volunteer firefighter up here in New Hampshire). But, despite the interruptions, I had no problem returning to the kit. Another thing that Heath has nailed down is what I call the "boredom factor." In other words, they know just when a certain portion of construction may become tedious, and before you get there, they'll have you go to another section of the kit.

The HW-101 went together in just under 60 hours (including 3 or 4 hours for alignment). After completing the transceiver, I moved on to the matching HP-23B power supply. This popular supply, which has powered all kinds of amateur equipment in addition to the Heath units it's made for, provides the operating voltages necessary for fixed station operation. It seems very well filtered, and went together in a couple of hours.

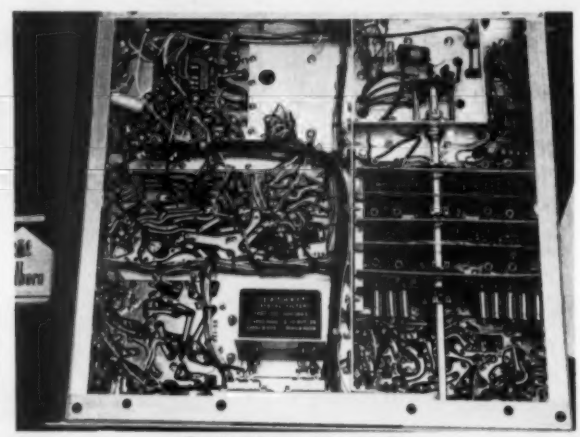
Alignment of the HW-101 is very simple, and can be completed without thousands of dollars worth of test equipment. Actually, all that is required is a VTVM and Heath's trusty alignment tool (which is included with the kit). I thought that the VFO alignment might be a little tricky, but it really wasn't at all. During alignment of the VFO, I found that the frequency counter on WA1UNN's test bench was quite handy for initially determining the VFO's frequency. Heath does give you a method of using another receiver to hear the VFO's output, so a counter is not essential. The remaining alignment is very simple and straightforward. The built-in crystal calibrator is used as a signal source and the S-meter as a peaking meter. We got the receiver section alignment completed and connected the unit to a dummy load. Now for the infamous "smoke test."

I turned the mode switch to tune and, uh-oh ... nothing! Well, not quite, but the output was very low. I turned the unit off and mumbled something about Murphy showing up on schedule. Then I took the unit home and went over all the step-by-step instructions, but could not find any wiring errors. Now what? As the manual suggested, I had another pair of eyes look at it. Rich WB1ASL found the problem in less than an hour. I had placed one lead (from a resistor on the driver circuit) in the wrong hole on the circuit board, and it ended up to ground instead of going to the rest of the circuit like it was supposed to. If I had only been a little less anxious, this minor error would not have happened. Well, anyway, the rig fired up just great after correcting the wiring error, and the rest of the alignment procedure was completed.

At home I had raised a 500-foot longwire antenna, and had no idea how the swr would stack up. I got home just in time to listen in on the first weekend of the ARRL DX contest. The swr on 15 meters was about 3 to 1. The Heath pi-network output section took it right in stride and fired right up. Had I been using transistors instead of tubes in the final, such a match would have been impossible.



The completed HW-101 and power supply. Size is compact, especially after locating the supply in Heath's matching speaker (not illustrated).



The "guts" view of the HW-101.

One of my first contacts was with Len W8LF in Senegal! Since then, I have received many excellent reports from stations all over the country and the world, with high marks for audio quality. The performance of the HW-101 has been more than satisfactory.

For CW operation, I later added the optional 400 Hz filter. It really makes the weak ones come right up out of the mud. It's good and sharp, yet not so sharp as to cause any annoying ringing. Break-in on CW is accomplished by operating VOX from a keyed tone, which works out quite well. Those of you who are high speed CW ops may want the VOX delay set in a position that facilitates quicker receiver recovery. That position may not be best for VOX operation on voice, but it is no problem to quickly readjust the VOX delay (since all VOX controls are mounted on the right-hand side of the transceiver and are easily adjusted without any cover or cabinet removal). Located nearby are the S-meter zero control and bias adjustment.

Although the HW-101's dial readout is only in 5 kHz increments, the receiver has plenty of selectivity and bandspread. This is evident on SSB, due to a 2.1 kHz crystal filter and the fact that it takes 35 turns of the large tuning knob to go from one end of the band to the other. I found the tuning to be surprisingly smooth, without any discernible backlash. After about a 20 minute warm-up period, the rig seems to be very stable. No measurable drift could be detected after warm-up.

Transmitter tune-up is simple – the preselector is tuned for maximum received signal at the desired operating frequency. This also sets up the transmitter driver tuned circuits to the approximate peak position. The final tune and loading controls are then tuned for maximum output. The mic/CW level is then turned up to maximum output, and you're all set. The meter switch may then be moved to the plate position to check for proper plate current.

The front panel controls are laid out well. In the receive mode, there is metering of signal strength. While in transmit alc, plate current or relative output may be monitored. The dial and meter are both backlit for easy readability.

The HW-101 is quite a rig to build on. I'm looking forward to constructing the mobile power supply and trying my luck while on a camping trip this summer. Also in the works are modifications for working RTTY. There is plenty of output to drive any linear amplifier on the market today, and the front panel level control is quite handy for this purpose.

I'd like to say that, in these inflationary days, I agree with Heath that the HW-101's price/performance ratio is an exceptional value. *Heath Company, Benton Harbor MI 49022.*

Bob Cunningham WB2UIJ
Fitzwilliam NH

73 TESTS THE TUNERS

We began this series back in March with the idea of covering as many antenna tuners as possible. Our staff has gotten to the point where they almost cringe with each new arrival, but you'd be hard-pressed to find one of us operating without one these days. To a man, we've all discovered the advantages – greater efficiency, reduced TVI, and cooler running finals. In future months we'll be looking at some of the less expensive tuners ($40 price class), and hope to finish up with a look at some home brew versions. So read on, and keep us posted on what gear you'd like us to test for you!

DENTRON 1 KW SUPERTUNER

In the middle ground between the $59.50 Dentron 80-10 Skymatcher random wire tuner (see the March *73*) and the $299.50 Monitor tuner (see April) lies the area where most amateurs hang their hats. If you live in an apartment or move a great deal, the random wire is your best antenna bet. On the other hand, if you run a full gallon all the time and are one of those people who go through long periods without food or rest to catch that rare DX, the super-duper model is probably what you need.

In a recent *73* survey, we found that the average amateur is on the air 8-10 hours a week, runs between 200-500 Watts, and budgets a few hundred dollars a year toward updating the shack. "Average" ham, meet the Dentron 1 kW SuperTuner! Retailing at $129.50, this unit is the perfect way to solve all of your matching problems without blowing your entire equipment budget in one fell swoop.

The SuperTuner is set up for just about any matching situation that you'll run into. A quick glance at the back panel shows sturdy screw terminals for balanced, unbalanced, and single-wire feed. An SO-239 for the more conventional antenna setup is also provided. The front panel features three controls for transmitter matching, inductance, and antenna matching. Tuning the unit is simplicity itself, using either an swr bridge or transmitter output meter. I had no problems perfectly matching a random wire, a standard dipole, and a beam. No worry about those finals going up in a puff of smoke either.

The SuperTuner is compact enough to fit easily in any shack, but it's still solidly built. After taking out all the screws necessary to expose the guts, I found the unit well laid out, with heavy-duty components used throughout.

The Dentron SuperTuner covers the entire range of 160-10 meters. For the sideband gallon crowd, it's also available with the capability of handling 3 kW at $229.50. *Dentron Radio Company, Incorporated, 2100 Enterprise Parkway, Twinsburg OH 44087.*

Stan Miastkowski WA1UMV
Associate Editor

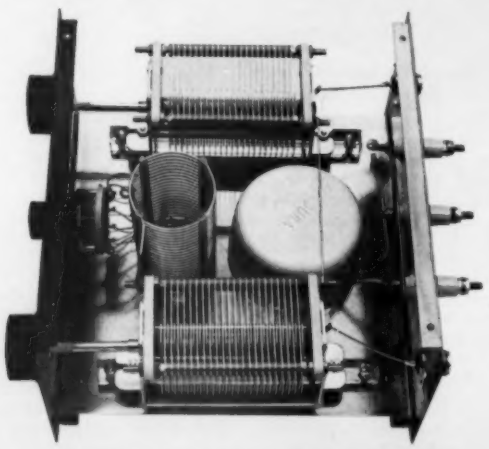
73 TESTS THE COMMUNICATIONS RECEIVERS

We continue this month with our series on general coverage receivers. Plans call for us to include some smaller, portable sets in future issues, along with the communications units we started off with. As one reader pointed out in a recent letter, SWLing is an integral part of ham radio in many foreign countries, where the prospective ham is required to confirm a specific number of countries before moving on to an amateur exam.

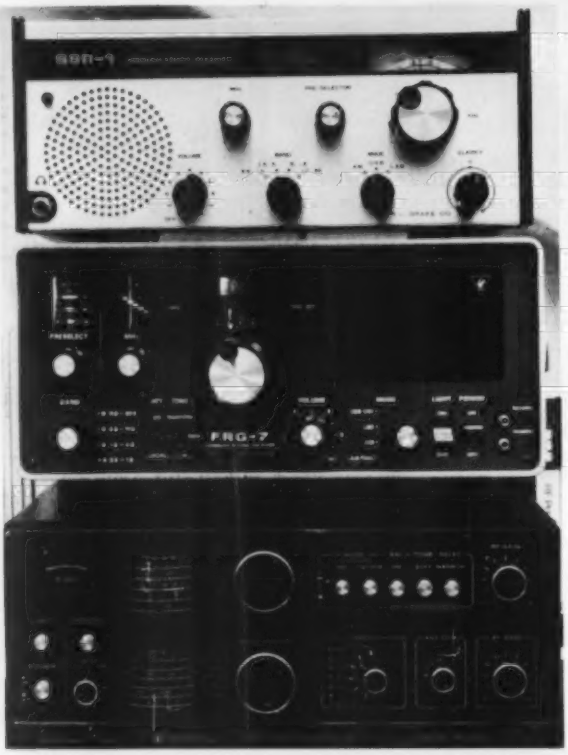
YAESU FRG-7 COMMUNICATIONS RECEIVER

My first real exposure to the world of communications receivers occurred many years ago, a few weeks before Christmas. I had just obtained a new WN8 call, and was ready to tackle the

The matching HP-23B ac power supply.



The SuperTuner interior view – a lot in a small package.



Several of the general coverage receivers undergoing testing by 73 staffers.

The Yaesu FRG-7 communications receiver, with some QSLs familiar to SWLs everywhere.

Novice bands. A search through greater Cleveland's ham emporiums unearthed a vintage Hammarlund HQ-129X general coverage receiver that served me well for quite awhile. However, as with most receivers of yesteryear (and of more recent days), there were several problems.

General coverage receivers have always been plagued with problems that result when a device is designed to satisfy the requirements of many. Tuning accuracy and stability are adequate for SWL use, but marginal for amateur use in bands overloaded with QRM. BFOs are optional on some general coverage receivers, rendering them ineffective for SSB and CW use. Many hams avoid general receivers for the simple reason that "bandspread," or the capability of stretching a small band segment over many revolutions of the tuning dial, is lacking.

I still have my classic Hammarlund, even though it is so unstable that I cannot accurately copy the evening RTTY bulletin on wide shift. However, a whole new breed of general coverage communications has recently arrived on the scene, filling a gap several years wide left when few radio manufacturers were paying attention to the SWL and general listening community. Recently, I was fortunate enough to obtain one of the newest and most technically advanced receivers to test, the FRG-7, manufactured by Yaesu.

My first reaction to the receiver was one of surprise when I picked up the box. Amazing! I could lift it and carry it with ease. It is totally solid state, and its design is based on the latest advances in digital technology. The tuning scheme is based on the phase locked loop frequency synthesis technique, which eliminates the dial inaccuracies characteristic of older communications receivers. It works as follows: The user selects the single megahertz band he desires to tune. This is accomplished by rotating a knob that turns a drum calibrated from zero to 29 (MHz). An LED indicator lamp next to the MHz control remains illuminated until the synthesizer "locks" on the desired megahertz band. When the LED goes out, the FRG-7 is locked into calibration, allowing perfect main dial accuracy. The main dial is calibrated from zero to 1000, and is covered by 10 full turns of the backlash-free tuning control. Resolution of 5 kHz is easily possible by splitting the eighth-inch dial divisions. The best part of the tuning scheme is, however, the fact that the same accuracy is provided for each MHz range. For the first time, an SWL can search for that elusive foreign broadcast station knowing he is on frequency, and the ham can use the main tuning control as a bandspread, due to the one MHz per band feature of the FRG-7. A "dial set" adjustment is provided to accommodate mechanical wear of the main dial components. A calibrated antenna preselector control is provided, and normally must be peaked several times while tuning across a one MHz segment. An rf attenuator is also provided, calibrated "normal," "DX," and "local." I found the "normal" setting to be adequate for all listening, as no receiver overload was experienced while testing the radio. The remaining front panel controls consist of a volume control, a three-position "tone" control, a mode switch, and two toggle switches. The latter switches control power and panel lamp illumination. The panel lamp switch is necessary, as the FRG-7 may be powered by an internal battery, consisting of eight "D" flashlight cells, rendering the receiver perfect for weekend trips. A front panel speaker is provided, as well as an earphone jack and recorder jack. The receiver is logically organized, and it only took a few moments to switch bands once the MHz switch and main tuning dial were mastered.

Operating the FRG-7 is a pleasure. I have always enjoyed SWLing, even though it has been a few years since I sat down and actively chased foreign broadcast stations. The tuning scheme is remarkably accurate, and all the stations appeared on the dial exactly as they were listed — no 5 kHz fudge factor as with non-synthesized communications receivers. The FRG-7 should appeal to the avid SWLer or broadcast DX hound for that reason. Sensitivity is good on all bands, and only an occasional tweaking of the antenna preselector was necessary to bring 'em out of the noise. (The antenna used for the SWL sessions was a 350' longwire.) The mode control has positions for AM, AM with noise limiting, LSB, and CW/USB. Each functioned correctly.

Performance on the ham bands was as expected for a receiver in the FRG's class. The "wide" main tuning dial effectively doubles as a bandspread control, and there was no difficulty copying stations on the low bands. Sideband reception was excellent, and it was strange not using a BFO control to tune them, as is common practice with older communications receivers. However, it was difficult to sort them out during the pileups on contest weekends. A "clarifier" control would have been a nice feature for SSB reception, but then again, the FRG-7 was not designed as an amateur receiver. In my opinion, the FRG-7 would make a fine Novice receiver, or a "second" receiver for the seasoned amateur. In any case, it's a perfect rig for vacation and weekend trip use. The battery pack makes it usable even in remote cabins, or onboard a boat.

The FRG-7 has three antenna connectors, a ground, and a muting connector on the rear panel. The broadcast band requires a separate antenna, and both a clip-type and standard SO-239 coax connectors are provided for high frequency use.

The Yaesu FRG-7 is definitely a big improvement over my old Hammarlund workhorse receiver. Its performance is definitely "ham standard" in the areas of accuracy and sensitivity. Its price and versatility, as well as portability, make it an ideal SWL receiver. At *73* we even used the FRG-7 as the low i-f receiver for tuning up a 432 MHz converter destined for EME use. No problems were encountered, and the battery power sure beat running a fifty-foot extension cord which would have been required for other receivers. For those of you needing a second receiver with state-of-the-art features, it would pay to consider the Yaesu FRG-7. Who knows — you might end up retiring your present receiver! *Yaesu Electronics Corp., 15954 Downey Ave., Paramount CA.*

John Molnar WB2ZCF
Executive Editor

MFJ 1030BX RECEIVER PRESELECTOR

Recognizing that most receivers are perfectly adequate on frequencies below 10 MHz, MFJ Enterprises has designed its new model 1030BX preselector to cover 10 to 30 MHz, where many receivers, particularly the older and less expensive sets, do fall short on performance.

Using a protected dual-gate MOSFET for extremely low noise, the unit has excellent strong signal handling ability and easily meets the manufacturer's claim of providing a typical increase in gain of 25 dB.

Although a bit more expensive, the 1030BX uses separate input and output tuning controls to provide maximum gain and selectivity while eliminating the tracking problem of a dual-gang capacitor.

The two high-Q double-tuned circuits provide a real improvement in weak signal reception while significantly reducing out-of-band signals and images. With the preselector on and properly "tweaked," you can cut back on the receiver's gain, reducing receiver cross modulation and overload problems while maintaining an excellent signal to noise ratio and the ability to pull out the weak ones.

Using the model 1030BX with a Radio Shack DX-160, a World War II vintage BC-348, and a Barlow-Wadley XCR-30 resulted in a significant improvement in performance in each instance. In fact, at one midtown New York City location, the preselector made the difference between useful reception and a total wipeout. The MFJ 1030BX preselector can be highly recommended to both amateurs and SWLs seeking to improve the performance of their receivers.

Packaged in an attractive Ten-Tec enclosure measuring 2-1/8 by 3-5/8 by 5-9/16 inches, the model 1030BX receiver preselector sells for $49.95. Unconditionally guaranteed for one year, the preselector is available from dealers or direct from *MFJ Enterprises, PO Box 494, Mississippi State MS 39762.*

Morgan W. Godwin W4WFL
New York NY

The MFJ Receiver Preselector.

MICROWAVE ASSOCIATES "GUNNPLEXER" 10 GHz AMATEUR TRANSCEIVER FRONT END

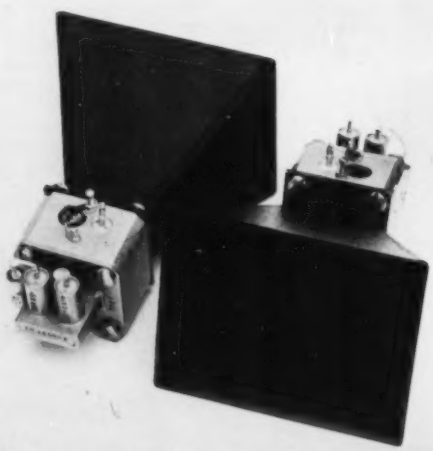
Microwave Associates of Burlington, Mass., has introduced a microwave transceiver "front end," designed specifically for amateur use. The MA-87127 Gunnplexer is an electronically tunable, frequency modulated oscillator operating in the amateur 10.0 to 10.5 GHz band. The oscillator produces about 20 mW of microwave energy directly from a 10 volt supply. A Gunn diode is used in the oscillator, and a portion of the energy is used to provide injection for a receiver mixer diode. The oscillator and receiver are isolated by a special ferrite circulator. The oscillator may be frequency modulated by applying voltage to a varactor diode included with the rf head. The Gunnplexer has a mechanical tuning range of about 100 MHz, and may be electrically deviated over a 60 MHz range.

In order to use the Gunnplexer as a communications device, the user must provide an i-f receiver and modulating source. The i-f range is customer selectable at time of purchase, and is typically in the range of 30-200 MHz. A standard broadcast FM receiver may be used as an i-f receiver for experimental applications. Microwave Associates claims that a communications range of up to 100 miles can be achieved with two Gunnplexers under optimum conditions. A narrow (10 kHz) i-f is required for such DX communications.

The microwave devices are not limited to communication applications, however. A Doppler effect radar transceiver can be built using a single Gunnplexer, based upon application information available from the manufacturer. Options for the Gunnplexer presently consist of a gain horn antenna that bolts to the rf head.

The *73* staff has recently obtained two Gunnplexers. A complete communication system is being developed employing a phase locked control circuit. Watch *73* for complete details as the system is refined. Preliminary tests indicate, however, that the Gunnplexers perform as advertised. These devices should eventually interest repeater owners, as the potential for a troublefree, wireless link is definitely attractive.

The following are available from Microwave Associates: MA-87108—Gunn Oscillator and Varactor, $60; MA-87127—Complete Transceiver, $85; MA-87140—Complete Transceiver and Antenna, $108; MA-87141—Two Transceivers and Antennas, $180. *Microwave Associates, Inc., Burlington, Massachusetts, (617) 272-3000.*



The Microwave Associates "Gunnplexer" 10 GHz Front End.

THE HEATHKIT ET-3300 LABORATORY BREADBOARD

Breadboarding has traditionally been a necessary, but often tedious, part of amateur and professional electronic design. Although a number of methods of breadboarding exist, none has really made the job easier, only different. On the one hand, we find projects tacked together on little pieces of perfboard or some sort of "universal printed circuit stock." On the other hand, there are those who prototype their projects on little pieces of phenolic material equipped with any of several types of horrid little spring clips.

The first really convenient breakthrough in breadboarding techniques came a few years ago when several companies began to offer terminal blocks set up as DIP-IC sockets with several contacts bonded together on 0.1 inch centers required for IC mounting. The only problem with these for amateur use was that they are expensive, especially when purchased as a lab breadboard with internal power supplies.

I recently bought and assembled the Heathkit Model ET-3300 laboratory breadboard. Total assembly time

NEW BOOK

RTTY HANDBOOK
see page 192

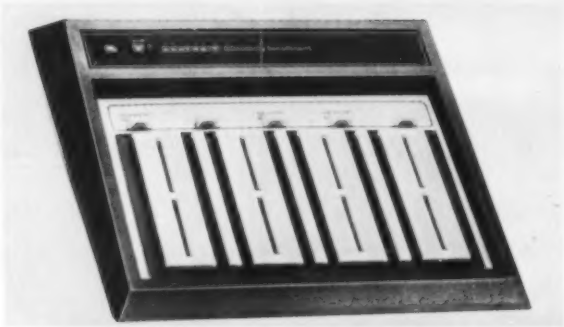
was a little under four hours, and there were no hitches worthy of mention.

The ET-3300 has four solderless IC breadboarding sockets. Each socket has 48 rows of contact pairs on 0.1 inch centers, and will hold up 6 14-pin DIP ICs (24 total). There are also three common bus sockets that each have two rows of common terminals running the length of the socket.

To me the biggest attraction was the ET-3300's built-in power supplies. In the past, regular bench supplies were used and that meant alligator clip leads or solder-tacked power wires all over the place. Besides being clumsy and just plain unsightly, it also produced more than a few problems with hum pickup, ground loops (especially troublesome in rf or those logic circuits operating at high speed), and layout. These problems are reduced considerably and, in many cases, eliminated, by the socket designs and internal power supplies of the ET-3300.

There are actually three ground-referenced power supplies in the Heath breadboard. One is suited for TTL and other digital logic elements because it will provide up to 1.5 Amperes at +5 V dc. I personally feel that the 1.5 Ampere figure is a little high, because it is based on a heat sinked LM309 regulator, normally rated at 1.0 Ampere. Even though I have drawn 1.2 Amperes for about two hours, the device survived nicely. The remaining power supplies are +12 volt and -12 volt at 100 mA, and they will accommodate operational amplifiers, microprocessors, and certain linear (non-op amp) ICs. These supplies are regulated to within ±2% and the specs were found to be conservative on the model I tested. I noticed only a few millivolts difference in the 12 volt supplies as current was increased from 0 to 100 mA. These supplies are also current limited to prevent damage from the almost certain short circuits that will exist in breadboarding.

The cabinet design is easy to live with, and is suited to long breadboarding sessions with little fatigue. In other brands of breadboard (of similar design) I've used, the panel was either sloped too high or too low for comfortable use over a long session. The Heathkit version appears to have been designed by an engineer who has done extensive breadboard work using some of the same products I have dealt with. The others will tire out your forearm and wrists in much the same



The Heathkit Laboratory Breadboard.

manner as an inappropriate or poorly designed telegraph key.

Two things annoy me about the ET-3300, although others may feel that they are too minor for comment. One of these is my old paranoia over fuses inside the case, where a simple fuse replacement is a major undertaking. The other is that those four IC sockets are not assembled at the factory. They ship the empty shells and a zillion multi-pin inserts. I spent the better part of a half hour inserting those little metal contacts into the shell. My personal feeling is that I would prefer to pay a little more and have that chore done at the factory by a machine. Of course, this kit only costs $79.95 ($120 assembled), so I guess it isn't too bad.

It is my judgment, based on several years of experience, that the Heathkit ET-3300 is well suited to industrial, commercial, and amateur breadboarding requirements for both IC and discrete designs. It will cut your breadboarding time considerably, but in my view that is only the icing on the cake. Its main attraction is that it facilitates flexible breadboarding procedures by allowing you to make changes rapidly – and that will reduce not only breadboarding time, but also the anxiety quotient. Of course, its most endearing quality is that it gives these advantages while forming a closer impedance match between the world's money supply and my bank account!

Joseph J. Carr K4IPV
Arlington VA

ANALOG COMPANDOR FOR NOISE REDUCTION IN COMMUNICATIONS AND AUDIO EQUIPMENT NOW AVAILABLE FROM SIGNETICS

A dual-gain control circuit which incorporates a complete compressor and expandor into one linear IC is now available from Signetics.

Designated the NE570/571 Compandor (compressor/expandor), the analog device is designed for applications in consumer communications equipment, including telephone subscriber or trunk carrier systems and hi-fi audio equipment.

In such applications, the compandor can be utilized as a means of reducing noise, as well as interference from other communications equipment, according to Neal Williams, Marketing Manager, Consumer Products, for Signetics' Analog Division.

Either channel of the dual-gain circuit can be used as a dynamic range compressor or expandor. Each channel has a full wave rectifier to detect the average value of a signal; a linearized, temperature-compensated variable gain cell; an operational amplifier; and a bias system.

The arrangements of these blocks in the NE570/571 result in a circuit which can perform well with few external components and yet can be adapted to many diverse applications, according to Williams.

The new units are ideally suited for application as a telephone trunk or telephone subscriber N2 compandor which is fully compatible with the Bell System's low level tracking curve; as a high level fast attack limiter making possible small signal gain reduction by factor of 10; as highly flexible basic expandors or basic compressors, in which the size of input and output signals are adjustable; and as a "noise gate" which will mute the output when the input signal drops below -60 dBm.

The NE570/571 compandors are also useful for applications in similar dynamic noise reduction systems, in voltage controlled amplifiers, and in dynamic filters.

The compandor features a THD trim terminal in the circuit, which provides a means for trimming out offset voltages and thus trimming the distortion they produce.

Other features include operation down to a 6 V dc supply voltage (maximum rating is 16 V dc), a dynamic range of greater than 110 dB, maximum power dissipation of 400 mW, and an operating temperature range of -40° to +70°C. *Signetics, 811 East Arques Avenue, Sunnyvale CA 94086.*

JANEL LABORATORIES MODEL 01-A PRECISION CRYSTAL OSCILLATOR

Janel Laboratories has announced a new crystal oscillator capable of outstanding frequency stability. This new oscillator, Model 01-A, is ideal for counters, synthesizers, and communications systems, where it is possible to achieve about a 10 times improvement in temperature stability over commonly used TCXOs. The oscillator is available as a standard item for 10 and 4 MHz, and is therefore readily adaptable to most counters and other equipment. Adapter boards are available for lower frequencies such as 1 MHz or 100 kHz.

The 01-A oscillator features a proportional crystal oven that holds the crystal frequency within 2 Hz at 10 MHz, over an outside temperature range of -25 to +50°C. The rf output is TTL compatible, and only a single 12 volt power source is required. Self-contained voltage regulation provides immunity from changes in the supply voltage. The oscillator is much smaller than the usual oven oscillators – only 1-7/8 x 1-5/16 x 3/4 inches. Solder pins are provided for PC board mounting, or the unit can be mounted to a chassis.

A typical amateur application would be for use as a time base for a frequency counter. When measuring the frequency of a two meter transmitter, a temperature stability of about 30 Hz would be achieved. This compares with a stability of 300 to 700 Hz for most TXCO-type oscillators and 750 Hz to 3 kHz for uncompensated, high accuracy oscillators. *Janel Laboratories, 3312 S.E. Van Buren Blvd., Corvallis OR 97330.*

NEW SEMICONDUCTOR REFERENCE HANDBOOK

Just issued by Radio Shack, the nationwide electronics store chain, is a book every electronics experimenter or hobbyist will want. It's their new *Archer Semiconductor Reference Handbook*.

A cross-reference listing is included in the handbook for replacement of transistors, diodes, and other interchangeable devices. The total number of cross-referenced devices exceeds 36,000. These cross-reference/replacement listings are computer-selected and based on careful analysis of the important parameters of the listed devices.

The *Handbook* is a compilation of data on Radio Shack's line of Archer brand semiconductors. According to Radio Shack, every Archer device covered in this handbook is guaranteed prime – not "fallouts" or "seconds" – all are top quality, with known JEDEC, EIA, or manufacturer's numbers.

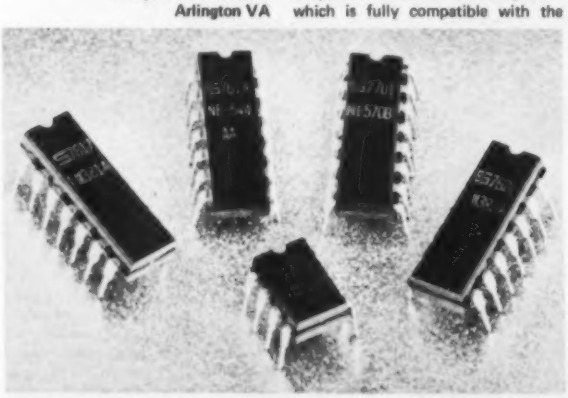
The handbook also has sections on the care and handling of transistors, soldering precautions, case styles and dimensions, and how to test transistors, as well as a glossary of words, symbols, and abbreviations.

The *Archer Semiconductor Reference Handbook* is available exclusively from Radio Shack stores and dealers. The 128 page handbook is priced at $1.95. *Radio Shack, a division of Tandy Corporation, Fort Worth TX 76107.*

PORTABLE DIGITAL MULTIMETER FEATURES 200 HOURS OPERATION

Data Tech announces a new low cost 3½ digit digital multimeter, with

Continued on page 40

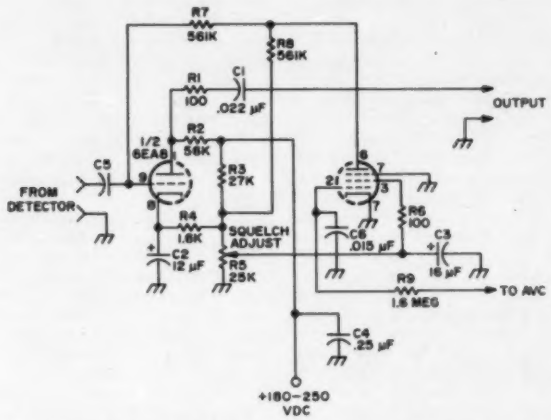


The second IC from the right is the Signetics NE570/571, which includes a complete compressor and expandor in one chip. The rest of the ICs are also Signetics products.

The Janel Laboratories precision crystal oscillator.

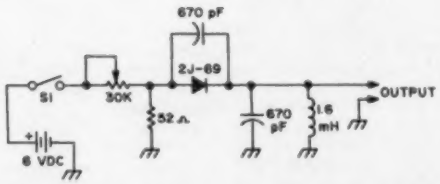
Q&A

This column will be a monthly feature of 73 Magazine. It is hoped that it will be of assistance to beginners and old-timers alike. We only ask that your questions be kept as general as possible. We will try to answer all queries received. Please mail your questions to Technical Editor, 73 Magazine, Peterborough NH 03458.



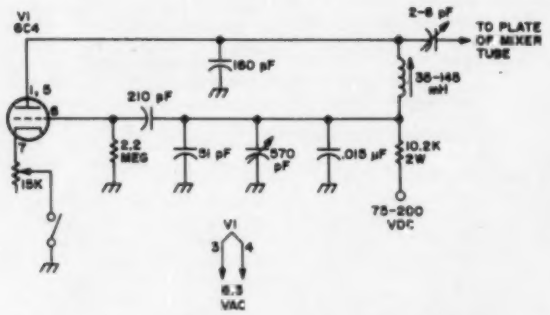
Q. Using one tube, how about a diagram for a squelch circuit?

A. See the figure. The only tube used in this circuit is a 6EA8. It must, however, be used with a set having avc. As shown in the diagram, this squelch is inserted between the second detector and the af volume control. For proper action, be sure there is good filtered dc. Use 1 W resistors throughout.



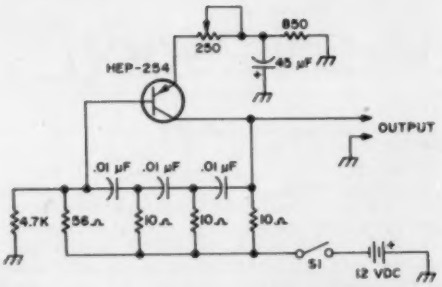
Q. Not using any crystals, and preferably a solid state device, recommend a 100 kHz sine wave oscillator which has a fair amount of stability.

A. This is a tunnel diode sine wave oscillator (see the figure) using a GE ZJ69 TD. When compared to a crystal oscillator, frequency was found to be stable as long as there were no drastic temperature changes. The sine wave output was nearly perfect. For long-term accuracy and stability, a crystal oscillator is recommended.



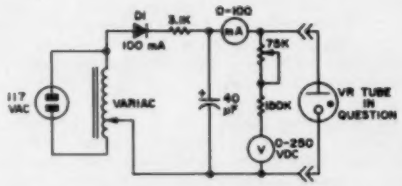
Q. Can a Q-multiplier be added to a receiver which uses an i-f of 1650 kHz?

A. Use the circuit shown. Mount the parts in a minibox for good shielding. Any voltage from 75 to 200 V will work fine. Although a 6C4 is used in the circuit, a nuvistor such as the 6CW4 also can be used. After installing, check the i-f alignment of the receiver.



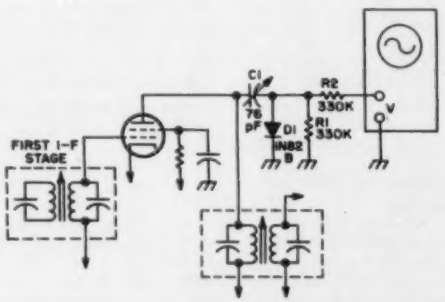
Q. Is there a way of designing an af oscillator so that it has an 800 Hz output?

A. Refer to the figure. The following transistors may be used in this oscillator: HEP-254, O.C.-2, SK-3004, AT30H. To increase the frequency, decrease the value of the capacitors in the ladder network.



Q. Is there a circuit for a simple VR tube checker?

A. The circuit in the figure works well. The variac voltage is varied up. When the VR tube fires, read the milliammeter and voltmeter. Good tubes will fire at their rated voltage and current.



Q. Is it possible to connect a scope to a receiver to see what incoming signals look like?

A. After installation of the signal takeoff and detector network (see the figure), the i-f stage may have to be realigned a bit.

Q. Is there an easy way to check the power output of a simple SSB exciter?

A. Yes – Connect the rf output of the SSB exciter to a dummy load (matching the output impedance). Across the load connect a vacuum tube voltmeter. Apply tone modulation to the exciter. Use the formula E2/R = P. Your answer will be average power, if you use an rms-calibrated VTVM. Make sure the VTVM is suitable for rf measurements.

Q. If, in nulling the carrier of an SSB transmitter, difficulty is experienced, what steps should be taken?

A. Disassemble the carrier null-trimmer capacitor and clean it with chloraphene. Remember, the carrier null should be set after the transmitter has thoroughly warmed up. For full carrier suppression, wait at least 20 minutes.

Q. Is it worthwhile to add a pot for vertical gain control to a scope with a step attenuator?

A. The circuit used for step attenuation is very effective and has a very wide range. Little will be gained by adding a pot. Furthermore, the vertical input is frequency compensated. The high input impedance of a good scope will be affected if a pot is added.

Q. Any idea as to what a sputtering noise within a small transmitter – when modulated – could be caused by?

A. With the room darkened, check for rf arcing in the final rf amplifier. Also look for arcing in the B-plus circuit due to close connections (sometimes due to vibration during transportation). Check for possible corrosion of various parts which could cause arcing.

Special Report

by Stan Miastkowski WA1UMV

REPEATER DEREGULATION — THE BOMBSHELL DROPS

It appears that the face and substance of amateur radio as we know it may be changing drastically in the near future. The key word is *deregulation*, a word that conjures up a wide variety of opinions. Is it good? Is it bad? Will it further amateur radio? Will it destroy it?

The process of deregulation has already started. It has come in small, bite-sized chunks. Novice class privileges were granted to Technicians, and instant upgrade has become a reality, as have code comprehension exams and the elimination of license fees. FCC field offices report that the number of new hams is climbing at an accelerating rate, portending great changes for our hobby.

Deregulation has come to the amateur community mainly because of one thing ... Citizens Band. The explosive growth of CB has created a migraine headache for the licensing, enforcement, and rulemaking departments of the FCC. Their limited budget and limited staff means that the most effort must be focused in the area of most concern. That has become CB.

Amateurs can be justly proud of their record of self-enforcement. The FCC realizes that we have so far managed to mold ourselves into a service that can be left alone, for the most part. But can it last? With the increased numbers come increased problems. Repeater wars, malicious interference, bad language, and even violence have been cropping up lately. Where it will lead remains to be seen.

Deregulation can be a double-edged sword. Like the elementary school class that is forced to stay after school because of one person's misbehavior, amateurs must suffer and pay (literally) for the misbehavers on CB. Witness the two notices of proposed rulemaking before the FCC at the moment. The sale of linear amplifiers would be banned in the 24-35 MHz band under one. Under the other, type acceptance of all amateur equipment would be required. Although the linear amplifier ban can be lived with since licensed amateurs would still be allowed to home brew them, the type acceptance proposal hurts ... right in the wallet. It's estimated that the price of an average transceiver would rise between $150-$300. It may be that amateur radio will become a rich man's hobby, like flying, horse racing, and yachting.

Despite the regression of type acceptance, deregulation is still the word within the FCC. The biggest bombshell is Docket 21033 ... repeater deregulation. In brief, it would completely eliminate the present repeater licensing system and allow any licensed amateur to set up his own repeater on any amateur band.

The second bombshell is Docket 20777, which would change the emission-type limitations within a band to bandwidth limitations. This docket contains the seeds of both increased regulation and deregulation.

These notices of proposed rulemaking are two of the most important dockets ever out of the FCC that concern the amateur community. What does the average amateur think of them? Is he even aware of them? *73* has made an effort to find out. Hundreds of questionnaires were recently mailed to a cross-section of amateurs throughout the country. The poll included everyone from new Novices to old-timers, from professional radio engineers to clerks. The common denominator is the amateur license and the love of the hobby. The questionnaire polled amateurs on repeater deregulation, bandwidth proposals, and general operating habits.

This month, *73* concentrates on repeaters — both the current situation and where it is going. The results of the survey are contained elsewhere in this report. What seems clear is that there are as many different opinions as there are amateurs. Many hams who responded to our questionnaire took the time to remark at length about the state of things as they now stand. There seems to be a feeling running through the ranks that *something* has to be done to keep our hobby from being swallowed by the combined forces of unplanned deregulation and CB pressure.

COORDINATION: IS IT WORKING?

Despite an overwhelming response that frequency coordination is working, respondents to the *73* survey indicated that they believe that a national system of frequency coordination is needed. What is the state of frequency coordination? The latest issue of the *73 Repeater Atlas* shows nearly 3000 repeaters in operation throughout the country. According to our files, some of the more popular frequencies contain the following number of repeaters:

146.64 — 91
146.67 — 75
146.70 — 72
146.73 — 78
146.76 — 164
146.79 — 78
146.82 — 133
146.85 — 90
146.88 — 149
146.91 — 72
146.94 — 229
146.97 — 73

With numbers like those on one frequency, problems are bound to crop up — and have. See recent *73* "Briefs" for a running account of the Ohio RTTY war over the use of 146.70. On the west coast, it appears that behavior on many repeaters has regressed to the kindergarten level.

IS CALIFORNIA THE SHAPE OF THINGS TO COME?

James Rieger WA6EZL tells *73* that, "The problem here is that ham operators are at war with one another. Neither will vacate a channel which neither can use because of jamming, because they would then be the 'loser.' Additionally, the jamming signals, the threats, the playback of party tapes, and other pranks cover substantial areas of Southern California. The channels are rendered useless to operators.

"My hope is that peer pressure and publicity will cause both sides to take a more adult attitude toward the problem. It apparently will not solve itself. It's been going on for months and is increasing in nastiness. As an amateur operator, I am embarrassed and disturbed by these activities." For an example of the California problem, see the letter elsewhere in this report.

What is to be done? Whether repeater deregulation is approved or not, it appears that some type of national coordination system, or at least some sort of interaction of coordination activity, will have to be instituted. As part of the *73* poll, we asked frequency coordinators what criteria they use for geographical separation. Here are some of the answers:

"Strictly non-interference. The older machine has priority."
"HAAT, ERP, terrain, anticipated area of coverage."
"75 miles."
"Try to minimize overlap."
"100 miles."
"Common sense."

Those are just a few of the responses that we received. It becomes obvious that there is little consensus. In 1975, the ARRL proposed a system of national frequency coordination which never got off the ground, due primarily to the opposition of many of the large repeater coordination groups. The proposal would have used ARRL-designated area frequency coordinators, who would have had power to enforce coordination in conjunction with the FCC. One of the plan's requirements was that the coordinator be an ARRL member.

Whatever the pros and cons of national frequency coordination, amateurs must remember one thing: The FCC wants no part of it. The key word in Washington, especially with the new administration, is *de*regulation. The time, personnel, and paperwork involved is something the FCC wants no part of.

THE 73 SURVEY

73 sent out nearly 300 questionnaires, of which 236 were returned filled out. The breakdown of license classes is as follows:

32 Novice
34 Technician

THE CALIFORNIA SITUATION — AN EXAMPLE

The following is a letter from a Southern California repeater owner to a person who is alleged to have caused interference.

Dear Mr. :

I have called your home on three occasions and spoken to you twice (and your wife once) concerning the activity. The only result I have gotten so far is an immense telephone bill. Thus this letter. Since you came close to promising moderation last time we talked and the next day started transmitting a tone every time your telephone isn't off the hook in an apparent attempt to "clear the channel," and generally threaten people with violence and mayhem on the air (which is what I was asking you not to do), I can't wait to see what you come up with next.

I will certainly admit that there are people in the Valley who are trying to jam you off the air — included in that group is at least one guy who is a bootlegger and a guy who routinely stomps on established conversations through his own, as well as others' repeaters, and a guy who claims 146.94 as his exclusive channel. They are unreasonable, irrational imbeciles. Unfortunately, so are you. If anything can be proven by seeing who can jam whom off the air, it will probably be eventually settled by the FCC, the cops, or whoever can hire the biggest, meanest hit-men.

As a minimum, I insist that you not use your repeater to jam simplex conversations. If it is in fact true that your users cannot hear existing simplex conversations, installation of a lockout receiver and/or reducing transmit power or antenna height will be required. Jamming conversations is definitely illegal, and if you don't know that it's taking place, you are not properly functioning as a control operator.

Since your end of this conflict is a club, whose members pay money to use the repeater, it is in their best interest to take solution-oriented (as opposed to gum-beating) action. Being a club, it should be easy to take this up with the membership at a meeting or through your newsletter. It is somewhat harder to stop jammers in three counties, but if an honest attempt is made on your part to end this funny business, I and a number of other individuals will help you find and take legal action against the jammers — which you are apparently unwilling or unable to do.

I am not threatening to invoke the FCC. I doubt they will do anything — they seldom do, and I hope this can be solved without them, anyway. However, I am sending copies of this letter to several amateur radio magazines and the SCRA, in hopes that peer pressure will cause moderation on both sides, or that at least people laughing at you will slow you down. I regret that any of this is necessary.

THE ARRL BANDPLAN

Repeater Channels		Direct Channels
INPUT	*OUTPUT*	
146.01	146.61	146.40
146.04	146.64	146.43
146.07	146.67	146.46
146.10	146.70	146.49
146.13	146.73	146.52
146.16	146.76	146.55
146.19	146.79	146.58
146.22	146.82	147.42
146.25	146.85	147.45
146.28	146.88	147.48
146.31	146.91	147.51
146.34	146.94	147.54
146.37	146.97	147.57
146.40	147.00	147.60
146.43	147.03	147.63
146.46	147.06	147.66
147.60	147.00	
147.63	147.03	
147.66	147.06	
147.69	147.09	
147.72	147.12	
147.75	147.15	
147.78	147.18	
147.81	147.21	
147.84	147.24	
147.87	147.27	
147.90	147.30	
147.93	147.33	
147.96	147.36	
147.99	147.39	

97 General
51 Advanced
22 Extra

According to the survey, amateur radio operators spend an average of 8-10 hours a week on the air. Most also subscribe to two or more amateur radio magazines.

What do amateurs think of the FCC's repeater deregulation proposal? Here are the results from the *73* poll.

1. In general, do you agree with this proposal?
Yes 38%
No 61%
No opinion 1%

2. Do you feel that the existing licensing system for repeaters is working well?
Yes 72%
No 22%
No opinion 6%

3. Should the existing repeater licensing system be eliminated?
Yes 18%
No 77%
No opinion 5%

4. Should any licensed amateur be allowed to set up a repeater without the need for a special license?
Yes 24%
No 74%
No opinion 2%

5. Should repeater operation be allowed in all amateur bands?
Yes 19%
No 74%
No opinion 7%

6. Should crossband operation be allowed?
Yes 77%
No 22%
No opinion 1%

7. Should repeater logging requirements be eased?
Yes 77%
No 20%
No opinion 3%

8. Should repeaters be monitored at all times by control operators?
Yes 34%
No 62%
No opinion 4%

9. Should remote bases be allowed to operate on simplex frequencies?
Yes 70%
No 18%
No opinion 2%

10. Is frequency coordination working in your area?
Yes 80%
No 1%
Don't know 19%

11. Is frequency coordination working on a nationwide basis?
Yes 30%
No 1%
Don't know 69%

12. Is a nationwide system of frequency coordination needed?
Yes 69%
No 23%
No opinion 8%

13. If so, who should administer the system?
FCC 9%
ARRL 18%
National System of Frequency Coordinators 41%
No opinion 33%

14. Should nationwide frequencies be set aside for RTTY and simplex?
Yes 72%
No 20%
No opinion 8%

THE PROPOSAL
(Excerpts from Docket 21033, Released January 6, 1977)

"Petitioners request explicit recognition of so-called 'remotely controlled base stations.' They state that considerable confusion exists concerning the definition and operation of remotely-controlled base stations, and that there is a need for specific rules to regulate the operation of such stations. Petitioners have proposed specific rules which, if adopted, would both add to the rules several provisions concerning remotely-controlled base stations and substantially relax the requirements for the operation of such stations.

"The petitioner seeks simplification of the Amateur Radio Service logging requirements, particularly the rules requiring the notation of all third party traffic sent and received, the retention of station logs for one year, and the recording of transmissions from 'open access' automatically-controlled repeater stations. The petitioner states that much of the logging required by the Rules is of little benefit to either Amateur operators or the Commission and requests that logging requirements be relaxed ac-

A FEW THOUGHTS FROM W2NSD ON THE REPEATER SITUATION

What About Creeps?

Since the FCC does not give psychological tests when they give ham exams, we have our fair share of nerds — and some manage to get set up for two meters, more's the pity.

A little kerchunking of repeaters now and then is not a capital offense, but some characters carry this to a fault. This isn't as serious as the frustrated ham who gets mad at a repeater group who decides to get even via the garbage mouth route. We are all used to hearing only the cleanest of language on our repeaters, so when one of these guys starts with the dirty words, many of us are liable to overreact.

If you stop and think about it for a bit, you'll realize that, though the stuff may be objectionable, it really isn't going to hurt anyone. So don't make a great big deal out of it. You do want to do what you can to get rid of the idiot, and getting angry is your worst response ... that's what delights him. He'll win a lot more attention that way.

Your best bet is to shut up and get busy with a direction finder on the input frequency (not the output — everyone knows where the repeater is). With a friend or two, you should be able to find the chap rather quickly. Then there is the question of how to get him to stop. If a phone call or a personal visit doesn't do the trick, you might think in terms of a personal visit by the entire club. A mob of fifty or so hams driving up and knocking on his door may get his attention.

Kerchunkers are harder to find. Their transmissions are usually a bit short for direction finding. There have been some successes with the use of a triggered scope. If you can get the chap on the input frequency and then measure the delay through the repeater, you can get a rough estimate of how far he is from the repeater. Another good trick is to use a fast triggered scope to see the leading edge of the kerchunker's signal. Oddly enough, every transceiver has a slightly different rise, and you can compare the kerchunker's pattern with those of other users later in the day. It is very unlikely that the kerchunker will never use the repeater normally. Eventually you'll spot him.

Open Repeaters, Closed Repeaters

As a traveler, you may run into the same thing I do. I get around a lot to harmfests, to see advertisers, etc. It is most discouraging to call in on the local repeater when you get to town and get no answer. I like to say hello, maybe find out a good place to eat, or a recommended place to stay. I announce myself on the repeater and hope for an answer. Nothing. I try again ... "This is W2NSD portable 8 standing by; anyone around to say hello?" Nothing.

Okay, perhaps there is no one listening right now — that can happen. But then about 20 seconds later on comes W8—— calling WA8—— and standing by for him. WA8—— comes back and they talk. It takes a very short time to get the message ... visitors unwelcome.

Other repeaters will put out the red carpet for you and make you happy you are a ham.

While I think we all appreciate that repeaters are not inexpensive to set up and maintain, on the other hand there is a nonprofit clause in the amateur regulations (no pecuniary interest) which must be kept in mind. Is it really legal for a repeater to use our non-commerical frequencies and force people to pay for the use of a specific frequency? I suspect not.

It would be a bit more expensive for closed repeaters to be set up on commercial channels, but it might be more honest. In the early days of repeaters, when there were far more channels available than were needed, perhaps we could afford the luxury of a small group settling down on a repeater pair and staking their claim ... all others keep off. Today, when new repeater groups are unable to find a single available pair for a new repeater, I wonder if we can still afford the luxury of private channels.

If it were brought to the attention of the FCC in any formal way, I'm sure that closed repeaters would be outlawed. Our rules are very specific about all of our frequencies being open to all. Not even long-time nets have any "right" to a frequency. A repeater does not have a "right" to a channel. The FCC felt strongly enough about this to spell it out ... if there is a station using the repeater output channel, the repeater control operator is not supposed to permit the repeater to be turned on and interfere with the chap on channel. Control operators do *not* observe this rule, but it is still the way things are as far as the FCC is concerned. Think about it.

LOOKING AHEAD

With the two meter band almost filled to capacity, and higher frequencies becoming increasingly crowded, the Southern California Repeater and Remote Base Association has planned ahead a bit. Here's a bandplan for 2300-2450 MHz.

Pair #	*Input*	*Output*
	2300.0 Lower Band Limit	
1.	2300.8	2350.8
2.	2301.6	2351.6
3.	2302.4	2352.4
4.	2303.0	2353.0
5.	2303.5	2353.5
6.	2304.0	2354.0
7.	2304.5	2354.5
8.	2305.0	2355.0
9.	2305.6	2355.6
10.	2306.4	2356.4
11.	2307.2	2357.2
12.	2308.0	2358.0
13.	2308.8	2358.8
14.	2309.6	2359.6
15.	2310.4	2360.4
16.	2311.2	2361.2
17.	2312.0	2362.0
18.	2312.8	2362.8
19.	2313.6	2363.6
20.	2314.4	2364.4
21.	2315.2	2365.2
22.	2316.0	2366.0
23.	2316.8	2366.8
24.	2317.6	2367.6
25.	2318.4	2368.4
26.	2319.2	2369.2
27.		2380.0
28.		2390.0
29.		2400.0
30.	2330.0	2410.0
31.	2340.0	2420.0
32.		2430.0
33.		2440.0
	2450.0 Upper Band Limit	

cordingly.

"We believe some of the proposals in the petitions we have received merit serious discussion, and we are herein proposing revision of Part 97 of the Rules which, if adopted, would result in a substantial simplification of the licensing and operation of stations in the Amateur Radio Service presently licensed as repeater stations, control stations, auxiliary link stations, and all other remotely-controlled stations, such as remotely-controlled base stations. The revisions we are considering would both accommodate many of the petitioners' wishes and be a significant step in the Commission's program of deregulation of the Amateur Radio Service.

"Since adopting rules governing the operation and licensing of associated stations in 1972, the Commission has steadily reduced the burden placed on applicants for and licensees of complex systems of amateur radio stations and has afforded such licensees increasingly greater flexibility in the operation of such stations.

"Our experience since adopting the rules regulating the licensing and operation of repeater and associated stations has demonstrated that amateur radio operators are fully capable of developing and operating complex systems of stations with a minimum of regulation by the Commission. We are aware of no compelling reason why amateurs wishing to operate repeater, auxiliary, control, or remotely-controlled stations should continue to be required to obtain Commission permission before beginning such operation, as they have in the past. For this reason, we propose to delete those provisions requiring that licensees obtain prior approval of the Commission to operate a remotely-controlled station and requiring that repeater stations, control stations, and auxiliary link stations be separately licensed. We would discontinue the issuance of station licenses with 'combined' station privileges: All amateur station licenses would convey authority to operate as repeater, control, auxiliary link, and remotely-controlled stations now operate.

"Similarly, we believe that operators of other remotely-controlled stations, such as remotely-controlled base stations, have demonstrated the capability of adequately controlling the emissions of such stations, and that the prohibition against the operation of such stations from control points in portable or mobile operation, presently contained in Section 97.110(b) of the Rules, may be unduly restrictive. Accordingly, we propose to revise the Rules to permit the portable and mobile operation of all primary, secondary, and club stations, when such stations are in auxiliary or repeater operation.

"Because no new station licenses would be issued to repeater stations, as such, we propose to discontinue our policy of assigning callsigns prefixed with the letters 'WR'. Stations presently assigned such callsigns would be permitted to retain them indefinitely. A licensee wishing to engage in repeater operation and wishing to obtain a 'WR' callsign would be required to request that prefix.

"Because stations in repeater or auxiliary operations would be taking advantage of specialized modes of operation, we believe the transmissions of such stations should be distinctly identified. We propose to require that auxiliary or repeater operations conducted by stations with 'traditional' callsigns be identified by the addition of a distinctive suffix to the station callsign. Stations in repeater operation would be identified by the addition of the suffix 'R', 'RPT', or the word 'repeater' to the regular callsign.

"A petitioner seeks relaxation of certain logging requirements, and we are considering deletion of the requirement that communications from open access stations in repeater operation under automatic control be either monitored in real time by the duty or control operator or recorded and the recording retained for a period of thirty days. This requirement, which was originally intended to ensure that licensees have the capability of determining whether their stations were being used properly during periods when no control operator was on duty, has proven to be of little benefit to the Commission and may unduly burden licensees operating 'open' repeater stations under automatic control. Of course, the licensee of the station would continue to be responsible for its proper operation.

"Additionally, it appears that many Amateur operators seek greater flexibility in the choice of frequencies for repeater and auxiliary operation. We are proposing to permit both repeater and auxiliary operation on all frequencies allocated to the Amateur Radio Service, except 435 to 438 MHz, and to delete the requirement that frequencies below 225 MHz used for auxiliary operation be monitored by the control operator before and during periods of operation. We would revise section 97.63 of the Rules, however, to emphasize the two principles which have made possible the efficient operation of many amateur radio stations in relatively small spectrum space, namely, that a station using a frequency has first priority in such use over other stations, and that all frequencies allocated to the Amateur Service are shared on a non-exclusive basis. It is presently the responsibility of amateur licensees to strike an appropriate balance between these principles to ensure fair and efficient use of the available spectrum.

"The Commission is aware that adoption of the rules proposed herein could result in a significant increase in the number of repeater, remotely-controlled stations, and associated activities pursued by amateur licensees. We are also aware that severe frequency congestion is present in some parts of the country, and that the possibility exists that increased interference might result from adoption of these revisions. Many amateurs have voluntarily established techniques for managing the available spectrum, and we commend such efforts. We are not prepared to make specific recommendations in this area at the present time."

THE LIGHTER SIDE OF REPEATER COORDINATION, FROM THE CHICAGO FM CLUB

Have you ever felt that you should have more power over others in amateur radio. Your ego need a boost? Tired of having sand kicked in your face by other people on the band whose only claim to fame is that they are better operators than you? Make something of yourself the easy "Repeater Council" way!

Just follow these easy steps, and many will think of you as God, just as you do:

1. Create a file of all legitimate articles that claim that repeater coordination is necessary. These can be rewritten and distorted later to support your dynasty when under fire.
2. Coordinate a few repeaters, preferably only those using surplus commercial gear or new commercial repeaters. Ignore the "amateur" amateur repeaters until they come crawling to you on their knees. You are building the base for your power structure.
3. When one of the "amateur" amateur repeater groups (henceforth referred to as "basement repeaters") complains of interference caused by a "coordinated repeater," offer to let them move to another frequency. If they decline, label them as a "pirate repeater," and do your best to destroy their credibility.
4. Attempt to be recognized by some national organization as the sole frequency coordinating authority. This is your big step towards credibility.
5. Be careful not to support experimentation, public service groups, or anything except for narrow band FM repeaters on two meters, 220 MHz, or 432 MHz. Ignore at all costs innovations like crossbanding, ATV repeaters, portable repeaters, SSB repeaters on 10 meters, etc. Steadfastly refuse to recognize simplex as a legitimate, useful mode, and refer to it as if it were merely a squatter on the "repeater band." (An alternative is to form a simplex council to coordinate simplex users.)
6. Above all, refuse to coordinate any repeater group who refuses to pay dues "... to support the council ..." This is easily accomplished by labeling any unpaid repeater groups as pirates and assigning the same frequency pair to another machine in the same area. If a group is not current in dues, even after being coordinated by you, refuse to send them any notices of actions by the council. If the bank account becomes suspiciously large and membership services are nonexistent, open another secret account at another bank.
7. Never allow the membership to vote on anything. Make all decisions in private, and advise the membership that an "executive decision" has been made. If something *must* be put to a vote, put it in final form before asking for comments, and ask for an approval of the "principles" involved, promising a new draft. Never record the promise of a new draft, and treat the first draft as the approved version.
8. If all else fails to maintain your absolute authority over the band, and if too many nonmember repeaters are going up, or coordinated repeaters stop paying you their dues, make a proposal to the FCC to make coordination (and therefore dues) mandatory for all repeaters. This is where the articles on the importance of frequency coordination can be distorted and used to advantage. If this docket is passed, you have established a real dynasty! You can stifle all experimentation and abuse your authority! You've made it to the top of the heap and created a "machine" which will feed your ego (and your pocketbook) for the rest of your life! Congratulations!

Review

THE RSGB VHF-UHF MANUAL
by D. Evans G3RPE and G. Jessop G6JP, Published by Radio Society of Great Britain, $12.95

The job of keeping manuals even somewhat abreast of the rapidly changing state of electronic communication art must be a frustrating one. It's even worse when the manual's subject is VHF and UHF, the frequencies where techniques have undergone the most rapid change.

In an effort to bring these changes to the radio amateur in handbook form, the Radio Society of Great Britain has brought out the third edition of its *VHF-UHF Manual*. Because UHF-VHF propagation is accomplished by a different mode than that for the high frequencies, the handbook's first chapter is devoted to an explanation of how these higher frequencies are radiated. Each of the several modes of propagation is discussed in great detail, and numerous charts are used to simplify and clarify understanding.

Tuned circuits peculiar to the high frequencies are described next. The transition from lumped constant to linear to cavity is shown. Then the selection of the optimum circuit for a stipulated application is aided by a comparison table. Coupling techniques for VHF-UHF are illustrated in profusion. The variety of transmission lines covered in the handbook may astonish some readers; each is presented in adequate detail. The helical resonator and microstrip lines are shown. In addition to the more conventional tuning methods, the use of varicaps is discussed. A logical transition from tuned circuits to receivers follows.

In the next chapter, noise factors are discussed, pointing out the many sources of noise in a receiver. This, of course, includes both vacuum tubes and solid state devices. Many (tube and transistor) circuits are shown for amplifiers, mixers, and oscillators (crystal-controlled and variable frequency). Unusual devices such as parametric amplifiers and hot carrier mixers are explained. Types of demodulators for FM, PM, AM, and SSB are shown in profusion. (One can never complain of not having every type presented!) Specialized circuits (squelch, etc.) associated with each demodulating method are given ample space. As is the custom in British publications, building instructions are given for many components (and even for a complete 2.3 MHz receiver). And these, still following British custom, are presented in minute detail.

As is to be expected, a chapter on transmitters follows receivers. In it, there is a considerable degree of repetition of information presented under "Receivers." Perhaps this is good, because it saves having to search under several headings to find the whole story. But there is new info, too, including excellent tables to help you select tube types, circuits for tuned stages, and even the length of leads that can be tolerated on fixed capacitors. The section on transistor power amplifiers is outstanding. So is the one on modulation theory. It even dares to explain "capture effect" in FM reception, a subject other handbooks avoid like the plague! Speech processors are touched on lightly, omitting any reference to truly modern methods. SSB, its principles, its several methods of generation, its amplifiers, and its transverters are accorded ample treatment. Much space is devoted to construction information. (As with the receiver section, these instructions are given in great detail.)

There's a short but good chapter on filters (bandpass, trap, etc.). Antennas rate a long chapter that starts out with the concept of an isotropic radiator and then progresses through power gain, bandwidth, aperture, and polarization. Each aspect is covered well. Next come feeders, their design and construction, and their matching to loads (antennas). Finally come antennas in all their multitudinous configurations. You'll find plenty of hard-to-get information, the type that never seems to be at hand when you're searching for it. There are tables for losses due to skin effect, or losses from the resistance of different metals used in elements, and information on electrolytic corrosion, arranged in an anodic/cathodic progression.

Microwaves, with their peculiar form of generator-to-antenna transmission (waveguides), rate a full chapter. Concerning waveguides, one finds out about the mode of propagation within the guide, how to get around a corner, how to tune a waveguide, how to devise a directional coupler, how to fabricate chokes. Next, one comes upon isolators and circulators. Perhaps more could have been said about these circuit configurations. Klystrons and Gunn oscillators (typical examples of vacuum tube and solid state SHF signal generators) are given a few pages. Then one gets to equipment — sixty pages of building instructions! Since there are only two practical ways of acquiring microwave equipment, "liberating" it from military or commercial sources or building it yourself, such a plentitude of construction details is indeed valuable.

The geometry of orbiting satellites starts out the chapter on space communications. This established, there's an explanation of free space path loss, and then a discussion of just what equipment an amateur would have to have in order to make contacts by way of a satellite. Moonbounce communication rates several pages.

The final chapter is on test equipment. Not all of this is unique to VHF-UHF, but the higher frequencies are favored. The measurement of rf power decidedly is slanted toward techniques peculiar to UHF. (I can't say that for the rf bridge described, though!) The several types of VHF-UHF dip oscillators are well-designed and building instructions are good. PIN diodes as attenuators, diodes as white noise generators, and FETs as crystal-controlled signal generators follow usual patterns. A very short mention is given to power splitters and combiners. A data section and an index conclude this book.

As with most publications, no matter how painstakingly proofread, goofs creep in. Small things, mostly, like errors in circuit drafting. These are easily spotted and should cause a careful reader little confusion.

The contributors and the editor of the *RSGB VHF-UHF Manual* have done a commendable job. It's factual. It's even interesting! And that's a large job for any technical book. I highly recommend it to any radio amateur who's truly interested in VHF-UHF. Interested, that is, beyond just playing with black boxes. Interested in expanding his comprehension of all of the many facets of communication in our higher frequency bands. *Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE.*

Carl C. Drumeller W5JJ
Warr Acres OK

THE BIG BROTHER GAME
by Scott R. French
Lyle Stuart, Inc. $7.95

Technology always filters down to the masses, someone once said, and he was right. Just last month, a Princeton University senior unveiled his design for a $2,000 atomic bomb (less plutonium) powerful enough to waste half of Manhattan yet small enough to fit inside a U-Haul trailer. Off-the-shelf texts contained sufficient data for bomb building.

While *The Big Brother Game* won't show you how to be the first on your block to blow up the world, it takes the wraps off well-kept secrets of government, big business, private investigators, and security agencies — how to bug a room, pick a lock, tail a car, play the credit game, change an identity, build a pistol silencer, be a spy. And as author Scott French implores, "If someone is doing it to you, stop it or do it back." He shows how to debug a room, evade followers, tell if your phone is tapped, keep premises secure, keep government out of your business, and obtain your government dossiers.

According to French, the FBI's Identification Division has files on over 190 million Americans. This includes anyone who has been in the armed services or arrested. Agencies other than the FBI keep citizen files, such as Welfare Departments, Public Schools, CIA, FCC, Veteran's Administration, and one of our favorites, the IRS.

Since the passage of the Freedom of Information Act in 1975, these agencies and others must allow citizens access to their personal files. French outlines steps to retrieve them.

While French sometimes skirts the legal edge, he rarely steps over it. After all, if it's okay for the FBI, it's okay for us; right? So, "Buy where the pros buy," French cajoles us. He lists names and addresses of manufacturers and dealers of polygraphs, bugging and debugging devices, shoe heel transmitters, lock-picking tools (used by police everywhere), and more.

And for the do-it-yourselfer, this volume contains 25 pages of James Bondian circuits, from wireless microphones to laser surveillance devices.

The Big Brother Book keeps a lively pace with tantalizing tidbits of private eye lore and nifty fun-to-tell facts — you can declare bankruptcy every 6 years and wipe out all your debts. The French police supposedly use a 25-35 kHz high-powered sound generator for crowd control. A chemical product sold under the name WD-40 spreads a light oily coating on objects which won't support fingerprints. Be the life of the party with these.

It's not the type of book you want to read straight through though. Rather, dip into it from time to time and slowly dribble information into your brain.

But for all this seemingly underground information, French warns us not to judge his motives for telling it all.

"You see," he says, "this information exists . . . Many already have this information and some are using it within the for-the-people, by-the-people law bit, some are not . . . Now by god, we all have it. Should you choose to go into the industrial spy business, start snooping around on your spouse, use this information for personal gain, use it to prevent others from abusing your rights, or simply just read it for the love of curiosity's sake, the responsibility is yours."

So it goes. Mr. French keeps the technology filtering down, and the rest is up to us.

Larry Kahaner WB2NEL
Brookline MA

THE RADIO AMATEUR'S LICENSE MANUAL
Published by the American Radio Relay League, Newington CT, $1.50

The latest ARRL license manual, the 75th edition, has quite a lot of information for the money. It gives questions for study of the five classes of licenses, as well as general information on amateur licensing, international regulations, US regulations, a chart of the frequency subbands, US radio districts, and examination schedules for all the FCC examination points.

A great deal of the information in certain sections is obsolete, due to changes in the FCC regulations, but the corrections are in the back of the book, which you should read first. There are four pages which bring the information substantially up to date.

There are no more fees, for the moment, and the Novice power limit has been raised from 75 to 250 Watts. These two points are not covered. Changes in the logging rules are not as clearly explained as I'd like. The new rules eliminate all logging except the date the station is first put into service

and the date it is taken out of service, unless you have handled third party traffic or have permitted another licensed amateur to control your station. Third party traffic, of course, includes letting anyone, even a member of your family present in the shack, talk on the station transmitter.

Probably the most important change, which is not mentioned, is the fact that Technicians have been given credit for having taken their test before an FCC examiner, and are entitled to become a General licensee by merely passing a 13 word per minute code test. The Technician test was the same in coverage as the General license and thus the amateur has been able to become a General without appearing before the FCC for a written exam. (Of course he must still appear for the code test.) This should inspire a lot of Technicians to become Generals.

The manual does not make specific answers available for memorizing, but gives enough coverage of each answer so that by study you can cope, we hope, with any variation of the question. Often, when an answer is memorized, a slight change in the wording of the question makes the memorized answer completely wrong.

If I were just starting in radio, looking ahead to the material for higher classes of license beyond the Novice would probably scare me a little. If I lacked motivation, I might give up the whole idea. I believe I would rather start with a study guide for a Novice only, and cross the next bridge when I came to it.

The other thing is the fact that with all the changes in the rules evident in the manual, requiring changes in the book, I would wonder if the rest of the book would be useful to me when I was ready to step up to another license. I think I would rather have a current book.

Jerrold A. Swank W8HXR
Washington Court House OH

MAINTENANCE SERVICE MANUAL, FT-101 SERIES
Published by Yaesu Electronics Corp., $25.00

Yaesu has been importing FT-101 transceivers now for over six years, and it's pretty hard to find anybody who doesn't respect their quality and portability. Over those years, Yaesu has steadily improved the 101, incorporating receiver improvements and increased frequency coverage. Three basic versions of the 101 have been produced, ranging from the original FT-101 to the FT-101-B, and the current FT-101-E/EE/EX series. Hundreds of thousands of these radios are in use around the world, along with Yaesu's line of accessories.

Now Yaesu has gone a step further than the normal operating manual provided with the 101 series transceivers — they've produced a maintenance service manual that every 101 owner ought to have. To quote Yaesu General Manager Bernie Tower's (W6RNW) introduction, "We have departed from the traditional 'military format' in writing technique and the style may seem too informal on first reading; however, remember that our goal was to make this manual easy to use." The contents are excellent, with an orderly flow through installation, tune-up, theory of operation, and parts identification in the opening section, plus step-by-step coverage of accessory interface and disassembly of the unit in section 2. In all, there are nine segments to the manual, including thirty pages of factory-recommended modifications. (That will probably be the most sought after portion of the manual.) In addition to the hundreds of schematics and x-ray views of the PC boards contained in the first eight sections of the book, Yaesu also included 9 foldout schematic diagrams covering all three versions of the FT-101. To conclude, we turn again to Bernie Tower's introduction. "You will find inside these covers not just a list of clipped out circuit descriptions and redrawn prints, but also all the tricks and neat stuff that the factory has developed — extras that never show up in operators' manuals, such as part location data, test points, a wealth of 'How To Do It' instructions, and the special information our service files contained." That says it in a nutshell!

Warren Elly WA1GUD
Assistant Editor

RADIO COMMUNICATION HANDBOOK (Vol. 1)
Published by Radio Society of Great Britain, $18.95

One weakness of handbooks is the inability of publishing one that is abreast of the state of the electronic art. This weakness is compounded when revisions are made attendant to bringing out later editions. There's just too much temptation to carry over material from the previous printing, sometimes in its entirety, sometimes with minor updating.

The fifth edition of *Radio Communication Handbook*, edited by Pat Hawker G3VA, shows that a determined effort was made to avoid such a pitfall. The effort was partially successful.

Volume 1 of the new edition shows promise of being a noteworthy advance in handbook publication. Much obsolete material has been eliminated, with old subjects treated in a new way and new techniques introduced.

Why should American radio amateurs go to a British handbook when there are several excellent ones published in this country? In partial answer, it may be said that the British pay more attention to details of theory, and much more attention to precise construction information. Another part of the answer may lie in the manner in which the British authors approach the explanation of principles. It's somewhat different, and there's no doubt that better comprehension of a subject can come from a study of a variety of presentation styles. It's good to bear in mind that this handbook does not replace any of the domestic ones. It serves to complement, not to supplant.

As is the case with other handbooks, this one starts with principles. But, unlike the others, it doesn't mention theory until it has introduced components, giving types and applications. Then it brings on the theory of how these components act in circuits. Although the theory is simple, the handbook does not presume the reader is "simple." The presumption is that the reader is intelligent and not frightened by the sight of a few mathematical equations. It's significant to note that the examples involve modern components and applications, a pleasant contrast to most handbooks (which have not changed from presentations that were old in the 1920s!). The *Radio Communication Handbook* is not totally devoid of faults, however, as it bows to the antiquated custom of having current flow opposite to electron flow!

The chapter on principles is extensive enough to cover not only the simple basics, but also to go far beyond to tuned circuits, filters, rf impedance matching, radiation and propagation, amplification, feedback, modulation in its many diverse forms, and its inverse: detection. It's thought-provoking to note that the British author declares the crystal detector to be the first-used type, undoubtedly causing his compatriots, Marconi (magnetic detector) and Fleming (thermonic diode), to flip in their graves!

Another chapter explains vacuum tubes. It is more or less conventional, except for the profundity of its detail and the space devoted to unusual tube types and applications. Modern design has drifted far away from the mundane applications of tubes, leaving only those instances in which the tube uniquely serves a purpose. And it's for these unique purposes that the text is admirably suited.

Only five pages are used to expound on the theory of semiconductors. Then the book gets into specific types, their behavior, and their applications. The author does it so well he can be forgiven for writing "cat's whisker" instead of "cat whisker." He's not the only one to make that mistake! He is to be congratulated on covering the IMPATT diode, the PIN diode, and the Gunn diode so effectively. Transistors of all commonly-used types are shown, and their uses discussed. ICs get short shift, with a promise to mention them later (in connection with their application in equipment).

Chapter 4, Receivers, starts by defining terms and talking about what would constitute a really good receiver. Then it describes the many generic types of receivers. This is done not so much in detail as in scope — the reader will have an acquaintance with just about every type of receiver used. Terms such as sensitivity, selectivity, stability, spurious responses, cross-modulation, blocking, intermodulation, and tuning rate are defined and expounded upon. Then design factors are discussed, with a wide range of choices. Circuits galore are shown. For the very ambitious, construction details are given. In this, one sees a marked difference between American and British handbooks. The British present much greater detail. Too, they expect the reader to construct more mechanical components. If you're a dedicated do-it-yourselfer, you'll appreciate such instruction!

A separate chapter is devoted to VHF and UHF receivers. As might be expected, it opens with the differences between designs and components for the higher frequencies, and those for the HF region. Next, it presents circuits — oscillators, buffers, multipliers, amplifiers, and mixers. The circuits are followed by construction details (with detail underlined) for a variety of receivers, converters, oscillators, preamplifiers, and power supplies. You'll even see such unusual items as a folded hybrid ring mixer using linear (not lumped constants) elements.

Chapter 6 is on HF transmitters. It follows the usual outline, with just a bit (in this writer's opinion) too much space on crystal oscillators. Oh, it's good. But maybe too good for the strictly limited use of crystal oscillators in modern transmitters. It's equally good on VFO design, discussing the effects of external factors (temperature, following stages, etc.) on short-term stability. There's an astonishing variety of VFO circuits, with component specifications. Both tube and solid state types are shown.

From oscillators, a logical sequence is followed to coupling circuits, and then on to buffers and amplifiers, with a sidestep to frequency multipliers. Power amplifiers, as might be expected, get the big play. A bit too much space is allotted to neutralized triodes. (When wes the last time you built one?) The design of tank circuits is given much (and merited) detail. Output circuits for both tube and transistor active elements are also discussed. Construction information is given for several transmitters.

Then, and only then (for some illogical reason), there's a discussion of the principles and merits of SSB. Then comes the usual plethora of circuits for generating DSB signals or SSB signals. Mixers are covered well, as are the considerations for mixing frequencies. The usual advice is given on the selection of a suitable active device (tube or transistor) for an amplifier, with due thought given to the various conditions that lead to linearity of operation. The use of two-tone af inputs to check PEP output is discussed in detail. Omitted, however, is any reference to the use of a spectrum analyzer as the ultimate device for ascertaining overall signal purity. A considerable space is given to construction of SSB transmitters. Both tube and solid state types are shown. In each instance, highly detailed information is provided.

The seventh chapter is devoted to VHF and UHF transmitters. It repeats quite a bit of information on crystal-controlled and variable oscillators. Linear circuits, both transmission line and cavity types, are explained very well, but there is some repetition of the modulation, mixing, and oscillator frequency selection data provided in previous chapters. Construction details are provided for several UHF transmitters, and they are probably

superior to any available in other handbooks.

A short chapter is devoted to keying and break-in systems. Some are simple, others complex. You can take your pick from a variety of types.

Considering current times, the *Radio Communication Handbook* devotes too many pages to the many methods of producing amplitude modulation (AM). It's improbable that a half dozen AM transmitters have been built in the USA or Canada in the past five years, and I doubt whether the system is any more popular among English builders! So why such detail? On the positive side, considerable space is given to frequency and phase modulation. Speech amplifiers are touched upon, as are speech processors, the latter in a rather uninspiring manner. The chapter is concluded with methods of measuring modulation quality.

The final chapter of Volume 1 is on radioteleprinters. It's short but adequate. In this instance, little construction advice is given. Textual material is followed by an excellent index. American readers may not care for the British practice of omitting page numbers in favor of chapter subdivisions. It's easy to live with, though.

In summary, Volume 1 of the fifth edition of *Radio Communication Handbook* fills a niche in radio literature that has been somewhat neglected. With a few exceptions, it's thoroughly modern, devoted to current techniques and components. It belongs on the bookshelf of every serious amateur of radio technology. But it should be set away on that bookshelf only after it has been well-thumbed! *Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE.*

Carl C. Drumeller W5JJ
Warr Acres OK

FCC

Report No. 12746
ACTION IN DOCKET CASE FCC PROPOSES TO SIMPLIFY AMATEUR LICENSING AND CALLSIGN ASSIGNMENT (DOCKET 21135)

On March 3, the Commission proposed to simplify the licensing and callsign assignment systems in the Amateur Radio Service.

The FCC said that the explosion in interest in personal radio communications had placed a heavy burden on those Commission staff issuing licenses. The Commission noted that it was aware that many Amateur licensees were dissatisfied with the speed of license processing and indicated it was considering methods to improve the process.

It added that its resources for processing amateur applications were extremely limited, and that its lack of resources now precluded all but the most basic licensing functions.

Accordingly, the Commission proposed to simplify Amateur licensing by discontinuing the issuance of all amateur licenses, other than primary station licenses, including military recreation, club, special event, Radio Amateur Civil Emergency Service (RACES), and secondary station licenses. (The Commission noted that in Docket 21033 it had proposed elimination of repeater, auxiliary link, and control stations.)

Licensees currently holding such station licenses would be permitted to retain them, but would not be able to renew them upon their expiration. In proposing elimination of all but primary station licenses, the FCC said that a disproportionate percentage of its resources were devoted to processing applications for non-primary amateur stations, which constitute only a small part of the amateur population, and that such resources must be allocated in a more efficient manner.

The Commission also recognized that elimination of the station types involved would have an impact on some individuals, but that it believed any such impact would be minor.

The FCC noted that the assignment of amateur callsigns also occupied an inordinate amount of staff time, and proposed to simplify the callsign assignment system in the Amateur Service by prohibiting entirely the assignment of specific callsigns and callsigns based on particular formats. All callsigns would be assigned on a systematic basis by the Commission under the terms of the proposal. Licensees holding Amateur Extra Class operator licenses would be permitted to obtain nonspecific 1x2 and 2x2 callsigns, however.

Comments on the Commission's proposals, which would amend Parts 1 and 97 of the Commission's Rules, are due by June 2, and reply comments by June 30.

Report No. 12743
ACTION IN DOCKET CASE FCC SETS "CLOSED SEASON" ON 2 TYPES OF AMATEUR RADIO APPLICATIONS (DOCKET 21135)

The FCC has announced that, effective March 3, there will be a "closed season" on filing applications for special event stations and secondary stations in the Amateur Radio Service. (A secondary station is a separate station licensed to an amateur operator for a location other than the primary station site, such as a vacation home or office. A special event station is one licensed for temporary use involving an event of either general interest to the public or of particular interest to amateur operators, and intended to draw favorable public attention to the Amateur Service.)

The Commission said that it had been receiving many frivolous applications for secondary station licenses during the past two months, and that these applications were beginning to burden its amateur radio processing staff. The Commission also said that it anticipated a flood of new applications for secondary and special event station licenses as soon as its proposals in Docket 21135, one of which is to eliminate the availability of such station licenses, are made public.

To make possible the continued efficient processing of other amateur radio license, the Commission imposed an immediate closed season on the filing of applications for special event and new secondary station licenses. All applications for special event station licenses or new secondary station licenses received on or after March 3 will be returned, the FCC said. Applications for renewal or modification of existing secondary station licenses will continue to be accepted.

AMSAT

Mode B users of the AMSAT-OSCAR 7 satellite were treated to an unexpected bonus of over three continuous weeks of orbits in which the 70 cm to 2m mode was kept on. This was done to reduce a battery overheating problem which had developed. In mid-December, 1976, the nicad battery temperature was about 36°C (79°F). As the weeks passed, the temperature began to increase because the orbit of A-O-7 was such that the satellite saw less and less of the earth's shadow. By January 17, 1977, the bird was in complete sunlight, and the temperature continued to rise at an alarming rate to over 44°C (111°F). This overheating was being caused by the constant charging of the battery, especially while in Mode A when the load is relatively light. Switching to the redundant charge regulator had little effect on the rising temperature, so the decision was made to command A-O-7's 70 cm to 2m on continuously, in order to reduce the charging of the battery.

With a number of stations still running excessively more than the recommended maximum 100 Watts ERP, there would have been more occasions of A-O-7 switching to Mode A or even worse to Mode D, the recharge mode. This switching of modes occurs when excessive current demands cause the bus voltage to drop below a preset level. When this occurs, the sensor's undervoltage signal causes the mode switch, which is supposed to protect the satellite's battery from being further run down. Even though the battery was being charged to a normal value, it was not able to supply the very heavy peak currents being demanded when high-powered satellite users were transmitting, so it switched modes.

In order to reduce the number of mode switches which had been occurring in December and January, we tried to keep A-O-7 in Mode C, which is a lower power 70 cm to 2m mode. When in Mode C, there were no more false mode switches, so the primary telecommand station for A-O-7, VE3SAT, commanded the satellite into this mode whenever possible. Because of its design, the satellite switches from Mode C to B after 24 hours have elapsed on the spacecraft's clock, and from Mode B to A after another 24 hours. When a false mode jump occurs, the clock is reset. This lets us know when the jump occurs, so we can see where the satellite was when this happened.

As you can imagine, commanding became very complicated when the mode jumping began to occur, but Randy's 8080 microprocessor-based command station came through with an excellent performance, keeping A-O-7 in the correct mode during the battery temperature crisis. By mid-February, the battery temperature began to stabilize, and then to decrease enough to allow A-O-7 to switch back to its normal schedule of Mode A on odd days of the year and Mode B on even days. This switch occurred on February 18, 1977.

One final note of interest concerning the VE3SAT automated command station: During the last week of the battery temperature problem, Randy was called away from home, leaving the automatic system on to run on the information programmed into its memory. Among the duties which it performed flawlessly were keeping the satellite in the proper mode, automatically commanding the 2m beacon from the codestore mode to the proper telemetry mode for an acquisition by WØLER of sun angle data, automatically loading the onboard A-O-7 codestore memory with a new message, switching the beacon from RTTY teletype telemetry to the codestore run (which played back the new message to the world for a day), again switching the beacon to the telemetry mode, and programming the satellite to switch to Mode A on February 18th.

A-O-6 NICAD CELL FAILS; SUNDAY DESCENDING NODE ORBITS DISCONTINUED

A failure of part of the 18-cell A-O-6 battery has forced the early curtailment of the Sunday descending node (north to south) orbits of the satellite. The failure of the cell was noticed by a number of telemetry gatherers who saw an abrupt drop in the channel 3A telemetry count, from counts around 62 to counts around 48. This indicated a problem in the upper half of the battery series string, since the half battery voltage measurement was normal (the lower half, that is). Since the battery is a series of cells, the failure of a single one has an adverse effect on the bus voltage. The bad cell acts somewhat like a diode when the battery is discharging, and like a series resistance when it's charging. The effect thus is lower available battery voltage and a reduced charging current. Combine the cell loss with the already reduced Ampere-hour capability of its 4-year-old battery, and the result is that the operating schedule of A-O-6 must be reduced.

The Sunday descending node orbits, which were scheduled to be available until the end of March, 1977, had to be discontinued. Also, the worldwide network of A-O-6 command stations has been instructed to turn off the satellite before it goes out of range during scheduled on orbits. The present schedule for A-O-6 calls for the transponder to be on for normal use on ascending node (south to north) orbits on Mondays, Thursdays, and Saturdays, UTC. This schedule will remain in effect as long as the battery remains stable at present levels. In the event of further degradation of the battery, it will become necessary to further cut back on the present schedule of the transponder.

Editor:
Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CONTESTS

My apologies to WA4BMC for incorrectly listing her address in the January issue as being in Lake Worth FL. The correct address is: PO Box 6811, Southboro Stn., *West Palm Beach* FL 33405. A large SASE with return postage for 3 oz. will bring complete information on county hunting and the MARAC organization, as well as mobile reply QSL cards, QSL bureaus, etc. Hope this did not inconvenience anyone.

TRIPLE LETTER QSO PARTY
Starts: 2000 GMT May 7
Ends: 2000 GMT May 8

All amateurs are eligible and invited to participate. Use all HF bands, 160 to 10 meters. One contact per band per mode (CW and phone only) with each station.

SCORING:

One point for each letter repeated in the suffix of the call of the station contacted. Example: WB2GFE = 1 pt.; W0ETT = 2 pts.; W0EEE = 3 pts. Two letter calls get one extra point. Multiplier is the total number of states, Canadian provinces, DX countries (other than US and VE), and number of 3-letter calls. Total score = QSO points times multiplier from each band.

EXCHANGE:

Serial QSO number and RS(T).

ENTRIES:

Send logs postmarked no later than June 1st to W0EEE, UMR Radio Club, Eng. Bldg., Univ of Mo., Rolla Rolla MO 65401. Mark the envelope: "ATTN: QSO PARTY."

GEORGIA QSO PARTY
Starts: 2000 GMT,
Saturday, May 7
Ends: 0200 GMT,
Monday, May 9

Sponsored by the Columbus ARC, there are no time or power restrictions, and contacts may be made once on phone and once on CW on each band. Oscar counts as one band. GA mobile or portable stations count as a separate station in each county.

EXCHANGE:

QSO number, RS(T), and QTH – county for GA; state, province, or country for others. GA to GA contacts are permitted.

SCORING:

Each completed contact counts 2 points. GA stations multiply QSO points by number of different states and VE provinces worked. DX stations may be worked for QSO points, but do not count as multipliers. Others multiply QSO points by number of GA counties (159 max.). No repeater QSOs permitted, except via Oscar!

FREQUENCIES:

CW – 1805, 3590, 7060, 14060, 21060, 28050; SSB – 3900, 3975, 7245, 14290, 21360, 28600; Novices – 3718, 7125, 21110, 28110. Try 160m at 0300 GMT, 10m on the hour, and 15m on the half hour during daylight hours.

AWARDS:

Certificates to highest scoring station in each state, province, country, and GA county. Other certificates as warranted. Plaques to highest scorers outside GA and GA mobile/portables.

ENTRIES:

Logs should show: date/time in GMT, call, exchange sent/rcvd, band, emission type, and multipliers claimed. Checklists appreciated. Include a signed declaration (usual) and mail your entry to Columbus ARC, c/o Jeanne J. Hunting K4RHU, 2701 Peabody Ave., Columbus GA 31904. Entries should be postmarked no later than June 6th. Include a large SASE for results. Note: Novices should designate their logs as such!

VERMONT QSO PARTY
Starts: 2100 GMT May 7
Ends: 0100 GMT May 9

Sponsored by the Central Vermont Amateur Radio Club, the contest is open to all amateurs. The same station may be worked once on each band and mode. Mobile stations may be worked from each new county. QSO Party contacts can be credited toward the W-VT (Worked VT Award) for working 13 of VT's 14 counties.

EXCHANGE:

QSO number, RS(T), and county for VT stations; ARRL section for others.

SCORING:

VT stations score 1 point per contact and multiply by the number of ARRL sections and countries worked. All others score 3 points per VT station worked and multiply by the number of VT counties worked *on each band.*

AWARDS:

Trophies to highest scoring station outside VT and single operator in VT. Certificates to high scorers in each ARRL section/DX and to 2nd, 3rd, and 4th highest scoring VTs. Special certificate, too, for multi-operator and mobile stations in VT.

FREQUENCIES:

Try CW on odd hour and phone on even hour GMT ... 3555, 7055, 14055, 21055, 28160, 50260, 144-144.5, 3909, 7290, 14325, 21375, 28600, 50360, 145.8, 3932.

LOGS:

In order to be eligible, logs or copies should be sent with an SASE before June 15th to: Peter Kragh W1AYK/K2UPD, 170 Summit Ave., Ramsey NJ 07446.

KANSAS QSO PARTY
Starts: 2000 GMT,
Saturday, May 14
Ends: 2400 GMT,
Sunday, May 15

Work each station once per band per mode. Remember that CW and phone segments are separate bands.

EXCHANGE:

KS send RS(T) and county; others send RS(T) and state/province/country.

FREQUENCIES:

Look for CW 55 kHz up from the bottom of the band, and phone 25 kHz above Advanced/General split.

SCORING:

KS stations multiply number of QSOs times sum of states, provinces, and other ARRL countries worked. Others multiply total KS contacts times the number of KS counties worked (105 max.).

ENTRIES/AWARDS:

Awards to top scorers in each state/province and ARRL country. Send logs and comments to: Robert Davis KØFPC, 1857 South 4th, Salina KS 67401. Be sure to include your name and address. SASE is not required for summary of results.

MICHIGAN QSO PARTY
Starts: 1800 GMT,
Saturday, May 14
Ends: 0200 GMT,
Monday, May 16

This year's contest is sponsored by the Oak Park ARC. This year phone and CW are combined into one contest. MI stations can work MI counties for multipliers. A station may be contacted once on each band/mode. Portable/mobiles may be contacted as new contacts each time county changes.

EXCHANGE:

RS(T), QSO number, QTH – county for MI; state or country for others.

FREQUENCIES:

Phone – 1815, 3905, 7280, 14280, 21380, 28580; CW – 1810, 3540, 7035, 7125, 14035, 21035, 21125, 28035, 28125. 1600 to 1900 GMT, try 15m on the hour, 10m on the half hour. VHF – 50.125, 145.025.

SCORING:

Multipliers are only counted once. For MI stations: 1 point per QSO times (states + countries + MI counties). KL7 and KH6 count as states. VE counts as a country. Max. multiplier = 80. Non-MI: QSO points times MI counties. Max. multiplier = 83. QSO points = 1 point each MI QSO, 5 points each MI special event station QSO (no ITU suffixes). VHF-only entries, same as above, except multipliers per VHF band are added together for total multiplier.

AWARDS:

Only single operator entries qualify. Several trophies, plaques, and certificates will be given, as appropriate.

ENTRIES:

A summary sheet is requested, showing scoring and other pertinent info (name and address in *block letters*, and a signed declaration that all rules and regulations have been observed). MI stations include club name for combined club score. Results will be final on July 30th, and will be mailed to all entries. Mailing deadline

CALENDAR

May 7-8	Triple Letter QSO Party
May 7-9	Georgia QSO Party
May 7-9	Vermont QSO Party
May 14-15	Kansas QSO Party
May 14-15	Mass. QSO Party
May 14-16	Michigan QSO Party
May 15	World Telecommunications Day – Phone
May 22	World Telecommunications Day – CW
June 4-5	IARS/CHC/FHC/HTH QSO Party
June 11-12	ARRL VHF QSO Party
June 18-19	West Virginia QSO Party
June 25-26	ARRL Field Day
July 2-3	QRP – Summer – Contest
July 4	ARRL Straight Key Night
July 9-10	IARU Radiosport Championship
July 16-17	Apollo II 8th Anniversary Contest
July 16-17	10-10 Net Summer QSO Party
Aug 20-21	New Jersey QSO Party
Aug 20-21	Worldwide SARTG RTTY Contest
Sept 10-11	VHF QSO Party
Oct 1-2	Open CD Party – CW
Oct 15-16	Open CD Party – Phone
Oct 15-17	Manitoba QSO Party
Nov 5-6	ARRL Sweepstakes – CW
Nov 13	OK DX Contest
Nov 19-20	ARRL Sweepstakes – Phone
Dec 3-4	ARRL 160 Meter Contest
Dec 10-11	ARRL 10 Meter Contest

is June 20th, to: Mark Shaw WA8EDC, 3810 Woodman, Troy MI 48084.

During MI week, May 14 to 21, all MI QSOs may be counted toward the following awards/certificates offered by the governor of MI:

1. A MI ham submits log info and names/addresses of 15 or more contacts made with out-of-state or DX hams with information regarding MI.
2. An out-of-state ham submits log information and names/addresses of at least 5 MI hams who related facts to him about MI (includes VEs).
3. Foreign ham (excluding any resident of Canada) submits the call letters and name/address plus log information for at least one MI ham who has told him about MI.

Only QSOs made during MI Week, May 14-21, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Gov. William Milliken, Lansing MI 48902.

WORLD TELECOMMUNICATIONS DAY CONTEST

Phone
0000 GMT to 2400 GMT, Saturday, May 15
CW
0000 GMT to 2400 GMT, Saturday, May 22

Sponsored by the Brazilian Ministry of Communications, this contest has been instituted in order to commemorate yearly the "World Telecommunications Day" (May 17th). Each participating radio amateur will attempt to make the highest possible number of contacts with the different ITU zones of the world in order to enable his country to win the ITU trophy. All bands, 160 to 10 meters, and all modes, phone/CW, may be used. Categories include: single op, multiband, fixed or mobile in maritime ITU zones 76 to 90, clubs/associations as multi-op/multiband.

EXCHANGE:

RS(T) and *ITU zone.*

SCORING:

Contacts with stations in same country = 0 points. Different country, same ITU zone: 10-40m = 1 pt., 80 and 160m = 2 pts. Different country, different ITU zone, same continent: 10-20m = 2 pts., 40m = 3 pts., 80 and 160m = 4 pts. Different country, different ITU zone, different continent: 10-20m = 3 pts., 40m = 5 pts., 80 and 160m = 6 pts. Final score is total QSO points times total number of different ITU zones. Same station may be worked on different bands for additional QSO points, but multipliers only count once regardless of bands. The country score will be the sum of the top five scores from the country on each mode.

AWARDS:

Gold, silver, and bronze medals will be awarded to the three highest scoring stations in the world on each mode. Diplomas will be awarded to the three highest scoring stations in each country on each mode. For countries with high numbers of entries, diplomas to the top three in each call area.

ENTRIES:

Separate logs for each mode and must show time/date in GMT, exchange, band, multipliers, and QSO points. Include a summary sheet. Logs must be postmarked before June 30th and addressed to: LABRE, UIT Contest Coordination, PO Box 07-0004, 70.000 – Brasilia, DF, Brazil.

SAN JOSE BICENTENNIAL AWARD

The handsome 3-color certificate of award offered by the Santa Clara County Amateur Radio Association to celebrate the 200th anniversary of the founding of San Jose, California, will now be easier to earn for ham radio operators outside the continental United States. For such stations, point values have been doubled over those originally announced when the certificate first became available. This change was made in recognition of the present low level of sunspot activity and consequent low level of casual DX activity.

The San Jose Bicentennial Award is given to all stations requesting it who accrue a total of 200 points, according to the table below. The list of stations worked must include a specified minimum number of SCCARA members (given in parentheses in the table) and may include contacts with either of the SCCARA club stations, W6UU or W6UW, other stations in the San Jose area (Santa Clara county), and stations outside of Santa Clara County but in the Pacific Division of the ARRL.

TABLE OF POINTS

From outside cont'l U.S.:	
W6UU or W6UW	100 points
SCCARA Members	50 (2)
Other S.C. County	4
Pacific Division	2
From 6th District outside S.C. County:	
W6UU or W6UW	20 points
SCCARA Members	10 (5)
Other S.C. County	2
In U.S., outside 6th Dist.:	
W6UU or W6UW	50 points
SCCARA Members	25 (2)
Other S.C. County	2
Pacific Division	1
From inside S.C. County:	
W6UU or W6UW	10 points
SCCARA Members	5 (10)
Other S.C. County	1

Applicants for the award should send their list of stations worked, with pertinent log data (no QSLs necessary) to the club secretary at SCCARA, PO Box 6, San Jose CA 95103. With the application, include $1.00 U.S. or 5 IRCs to cover part of the cost of preparation and mailing.

Bill Vette K6TXR was the designer of the San Jose Bicentennial Award certificate. Here he shows it to Dick Barrett W6CFK (on the left). Dick originally proposed that the club issue the award.

RESULTS

RESULTS OF THE 1976 EUROPEAN DX CONTEST, WAEDC – RTTY
Trophy winners:

CT1EQ – Europe single op
I1PYS – Europe Multi-op
WA@YDJ/4 – North America single op
W1MX – North America multi-op
DJ4KW/4X – Asia
I3-13018 – SWL

Of 41 entries listed in the results, only 3 were from the US, in the single op category – How about a little more activity next year?!

Southeast Asia, amateur prefix style. Thanks to Old Man, *the Bulletin of Swiss Short Wave Amateurs.*

Briefs

from page 18

isn't capable of handling the hundreds of complaints, and those who have nothing more than canceled checks to show for their Trigger orders may well have to hire their own lawyers to get their money back. The Illinois AG brought charges against Treger last year, but ran into delay after delay in seeking a court ruling. But, now that the court seems ready to act, Assistant AG McPhee's work is far from over. Next he must begin preparations for answering the hundreds of people who have filed complaints, and help them (or their attorneys) collect. "The trouble with my job," McPhee told *73*, "is that the work only really begins after the trial is over."

Recent interviews with FCC field office officials indicate that since the elimination of license fees early in 1977, the amount of prospective amateurs failing exams has drastically increased. Here are some results from a western office early in February: Technician – 5 passed, 4 failed; General – 3 passed, 15 failed; Advanced – 16 passed, 0 failed; Extra – 1 passed, 4 failed.

Thanks to the *West Coast DX Bulletin*: The FCC has reportedly clarified how to measure Novice power. Now the measurement must be all power into the final tube (exclusive of heater power). Thus a screen-grid final must not only include the plate input power but also the screen-grid input power. The *Bulletin* also reports that the Marconi Memorial Station, II4FGM, is usually active on weekends between 1600Z and 1800Z. That's 20 and 15m SSB and CW. QSL to I4BFY or PO Box 3113, Bologna, Italy.

We stand corrected on our March new product review concerning the Hy-Gain 3750 transceiver. We reported it to be the most expensive amateur transceiver available, but as K4AVU points out, the Collins KWM-2A is priced at $3533, nearly $1500 higher than the 3750.

All eyes had begun to focus on Dayton at deadline . . . the April 29, 30, May 1 extravaganza will hold quite a few surprises in the way of equipment and ham radio politics. It will also mean the naming of "The Radio Amateur of the Year" and "The Specific Event Achievement Award," aimed at one or more radio amateurs for participation in an outstanding event associated with ham radio during 1976. See you there!

Until recently, very little two meter coverage has been available on a large section of the Pennsylvania Turnpike, one of the most heavily traveled routes in the country. That's been changed, with the arrival of WR3AIZ, a 147.75/147.15 machine now operating from Blue Knob mountain, 17 miles southwest of Altoona PA.

Turnpike coverage extends from mile marker 100, near Somerset, to mile marker 200, near Carlisle, assuming average power and antenna. The machine is carrier-access and open to all, 24 hours a day.

Sign of the times in Canada: A licensed amateur operating a rig that was cleaned up to DOC recommendations was recently fined $100 dollars in small claims court in Quebec for "inadvertent jamming of radio and TV shows." Four of the man's neighbors filed the complaints, for which he could have been fined a maximum of $1600. The honorary counsel for the Radio Society of Ontario and the counsel for the Canadian division of the ARRL are currently investigating the case.

The Six Meter International Radio Klub (SMIRK) has proposed some interesting changes to the FCC. Assigned RM number 2832, SMIRK has petitioned for all classes of license (except Novice) to be granted CW status between 50.0 and 50.1 MHz, a segment currently reserved for Advanced and Extra. SMIRK argues that their plan would allow more Technicians access to CW practice through operating, since they'd need to add extra equipment to get on the Novice bands recently authorized at HF. Thanks to K5ZMS.

Updating our guest editorial last month on the Buffalo snow disaster: WBEN's lead in rebroadcasting CB and amateur traffic reports on the BC band has been endorsed by the NAB. In a filing with the FCC, assigned number RM-2830, NAB argues that broadcasters are in a good position to use emergency information taken from ham and CB sources for the public good. No opposition is reported.

With the deregulation of repeaters proposed by the FCC, frequency changes will be common. This could mean added crystal expense for users.

Clubs could follow the lead of the Minuteman Repeater Association, which used a "crystal bank" after their users invested in crystals for a repeater whose frequency had to be changed. Regular users of the Stoneham (MA) machine found that QRM from another repeater made copy difficult. All parties agreed that the Stoneham machine would exchange frequencies with a low power CD machine which was primarily used for emergencies. The Minuteman's editor reports that the frequency exchange is working fine.

An experiment in sporadic-E propagation on six meters is underway on the north coast of Brittany, France. A F3THF beacon is on the air at 50.1 MHz. It uses FSK keying at 170 Hz shift. Initial power is 100 Watts, although if no RFI problems are encountered, that will be raised to 1 kW.

The antenna is aimed toward Central America, and should provide the east coast of the United States some coverage. Initial plans are for the beacon to be on the air from May 1st to August 31st each year. Reports should be sent to Ed Tilton W1HDQ, ARRL, 225 Main St., Newington CT 06111. Thanks to the Six Meter International Radio Klub (SMIRK).

"Contestor's Luck" continued, sunspotwise, through the second weekend of the ARRL DX Contest. European signals on the East Coast surpassed the S9+ mark for two consecutive days, March 5th and 6th. Several long-time DXers called it the best 15m conditions in 3, even 4 years! CW weekends weren't bad either, with the first session serving up superb openings on 15m and 10m as well.

IRS (the Interstate Repeater Society) auction in Nashua NH. The 73 booth is at the left center with Technical Editor Rich Force WB1ASL, Executive Editor John Molnar WB2ZCF, and Marketing Director Sherry Smythe hard at work.

New Products

from page 30

200 hours battery life in a small hand-held case. The unit measures dc volts from 100 uV to 1 kV, ac volts from 100 uV to 750 V, dc and ac current from 100 nA to 20 A, and resistance from 100 uΩ to 20 megs. The basic accuracy of reading on dc V is 0.1% ±1 digit. Features of the Model 22 include: hand-held portability, 200 hours battery life (disposable batteries), large .5 inch LCD display, current measurement to 20 Amps, standard size batteries, overload protection, 0.1% basic accuracy, reading hold feature, and rugged construction.

The Data Tech Model 22 digital multimeter has been called the "Ultimate DMM," because no specifications are sacrificed to implement the small case size. The field service engineer can achieve laboratory grade accuracy in a hand-held DMM that can be read in direct sunlight.

The Model 22 is available with disposable batteries, nickel cadmium rechargeable batteries (60 hours operation per charge), or for ac operation. Optional accessories include carrying case, test lead kit, push-to-hold (reading) probe, high voltage probe, and rf probe. The basic selling price of the Model 22 is $234. *Data Tech, 2700 South Fairview, Santa Ana CA 92704.*

HARRISON HOTLINE

A new tollfree "Order Hotline" has been established by Harrison Radio Corporation for amateur radio equipment and accessories ordering. The new number is (800)645-9187. It will be available for use by retail customers, as well as the dealers being serviced by Harrison's "Two-Step" Division. The new WATS number is nationwide, excluding New York State.

NEW HEADQUARTERS FOR AP PRODUCTS

AP Products, Incorporated, of Painesville OH, is expanding its facilities with the addition of a new headquarters building.

The new building at 1382 West Jackson Street in Painesville is now housing the company's Customer Service, Accounting, and Management offices.

The original facility at 72 Corwin Drive, just around the corner, will now accommodate an expansion of the company's Engineering Services department.

Mail to the company can still be addressed to Box 110, Painesville OH 44077. The same phone number is still in use: (216)-354-2101.

LATEST LISTING MAY 1977

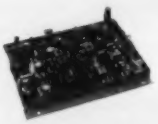
vhf engineering

36 NEW PRODUCTS

THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

RECEIVERS

RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter	$ 59.95
RX28C W/T	same as above—wired & tested	104.95
RX50C Kit	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX50C W/T	same as above—wired & tested	104.95
RX144C Kit	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T	same as above—wired & tested	114.95
RX220C Kit	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T	same as above—wired & tested	114.95
RX432C Kit	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RX432C W/T	same as above—wired & tested	124.95



RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50
RF28 Kit	10 mtr RF front end 10.7 MHz out	12.50
RF50 Kit	6 mtr RF front end 10.7 MHz out	12.50
RF144D Kit	2 mtr RF front end 10.7 MHz out	17.50
RF220D Kit	220 MHz RF front end 10.7 MHz out	17.50
RF432 Kit	432 MHz RF front end 10.7 MHz out	27.50
IF 10.7F Kit	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

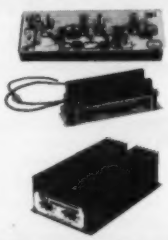
TRANSMITTERS

TX50	transmitter exciter, 1 watt, 6 mtr.	39.95
TX50 W/T	same as above—wired & tested	59.95
TX144B Kit	transmitter exciter—1 watt—2 mtrs	29.95
TX144B W/T	same as above—wired & tested.	49.95
TX220B Kit	transmitter exciter—1watt—220 MHz	29.95

TX220B W/T	same as above—wired & tested	49.95
TX432B Kit	transmitter exciter 432 MHz	39.95
TX432B W/T	same as above—wired & tested	59.95
TX150 Kit	300 milliwatt, 2 mtr transmitter	19.95
TX150 W/T	same as above—wired & tested	29.95

POWER AMPLIFIERS

PA2501H Kit	2 mtr power amp—kit 1w in—25w out with solid state switching, case, connectors	59.95
PA2501H W/T	same as above—wired & tested	74.95
PA4010H Kit	2 mtr power amp—10w in—40w out—relay switching	59.95
PA4010H W/T	same as above—wired & tested	74.95
PA50/25 Kit	6 mtr power amp, 1w in, 25w out, less case, connectors & switching	49.95
PA50/25 W/T	same as above, wired & tested.	69.95
PA144/15 Kit	2 mtr power amp—1w in—15w out—less case, connectors and switching	39.95
PA144/25 Kit	same as PA144/15 kit but 25w	49.95
PA220/15 Kit	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit	power amp—similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10 W/T	10w in—140w out—2 mtr amp	179.95
PA140/30 W/T	30w in—140w out—2 mtr amp	159.95



Blue Line . . . RF power amp, wired & tested, emission—CW-FM-SSB/AM

Model	Frequency	Power Input	Power Output	
BLB 3/150	45- 55MHz	3W	150W	TBA
BLC 10/70	140-160MHz	10W	70W	139.95
BLC 2/70	140-160MHz	2W	70W	159.95
BLC 10/150	140-160MHz	10W	150W	259.95
BLC 30/150	140-160MHz	30W	150W	239.95
BLD 2/60	220-230MHz	2W	60W	159.95
BLD 10/60	220-230MHz	10W	60W	139.95
BLD 10/120	220-230MHz	10W	120W	259.95
BLE 10/40	420-470MHz	10W	40W	139.95
BLE 2/40	420-470MHz	2W	40W	159.95
BLE 30/80	420-470MHz	30W	80W	259.95
BLE 10/80	420-470MHz	10W	80W	289.95

POWER SUPPLIES

PS15C Kit	15 amp—12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	79.95
PS15C W/T	same as above—wired & tested	94.95
PS25C Kit	25 amp—12 volt regulated power supply w/case, w/fold-back current limiting and ovp	129.95
PS25C W/T	same as above—wired & tested	149.95
PS25M Kit	same as PS25C with meters	149.95
PS25M W/T	same as above—wired & tested	169.95

O.V.P.	adds over voltage protection to your power supplies, 15 VDC max.	9.95
PS3A Kit	12 volt—power supply regulator card with fold-back current limiting	8.95
PS3012 W/T	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/fold-back current limiting and overvoltage protection	239.95

REPEATERS

RPT50 Kit	repeater—6 meter	465.95
RPT50	repeater—6 meter, wired & tested	695.95
RPT144 Kit	repeater—2 mtr—15w—complete (less crystals)	465.95
RPT220 Kit	repeater—220 MHz—15w—complete (less crystals)	465.95
RPT432 Kit	repeater—10 watt—432 MHz (less crystals)	515.95
RPT144 W/T	repeater—15 watt—2 mtr.	695.95
RPT220 W/T	repeater—15 watt—220 MHz.	695.95
RPT432 W/T	repeater—10 watt—432 MHz.	749.95
DPLA50	6 mtr close spaced duplexer	575.00

DPLA144	2 mtr, 600 KHz spaced duplexer, wired and tuned to frequency	379.95
DPLA220	220 MHz duplexer, wired and tuned to frequency	379.95
DPLA432	rack mount duplexer	319.95
DSC-U	double shielded duplexer cables with PL259 connectors (pr.)	25.00
DSC-N	same as above with type N connectors (pr.)	25.00

TRANSCEIVERS

TRX50 Kit	Complete 6 mtr FM transceiver kit, 20w out, 10 channel scan with case (less mike and crystals)	249.95
TRX144 Kit	same as above, but 2 mtr & 15w out	219.95
TRX220 Kit	same as above except for 220 MHz	219.95
TRX432 Kit	same as above except 10 watt and 432MHz	254.95
TRC-1	transceiver case only	19.95
TRC-2	transceiver case and accessories	39.95

SYNTHESIZERS

SYN II Kit	2 mtr synthesizer, transmitt offsets programmable from 100 KHz—10 MHz, (Mars offsets with optional adapters)	169.95
SYN II W/T	same as above—wired & tested	239.95
MO-1 Kit	Mars/cap offset optional	2.50
TO-1 Kit	18 MHz optional tripler	2.50

WALKIE-TALKIES

HT 144B Kit	2 mtr, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex	129.95
NICAD	battery pack, 12 VDC, ½ amp.	29.95
BC12	battery charger for above	5.95
Rubber Duck	2 mtr, with male BNC connector	8.95

OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/diode switching	$ 6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD3 Kit	UHF version of CD1 deck, needed for 432 multi-channel operation	12.95
COR2 Kit	carrier operated relay	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each).	5.00
CWID Kit	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed	59.95
MIC I	2,000 ohm dynamic mike with P.T.T. and coil cord	12.95
TS1 W/T	tone squelch decoder	59.95
TS1 W/T	installed in repeater, including interface accessories	89.95
TD3 Kit	2 tone decoder	29.95
TD3 W/T	same as above—wired & tested	39.95
HL144 W/T	4 pole helical resonator, wired & tested, swept tuned to 144 MHz ban	24.95
HL220 W/T	same as above tuned to 220 MHz ban	24.95
HL432 W/T	same as above tuned to 432 MHz ban	24.95

VHF ENGINEERING

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V5

Looking West

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

It's been just a couple of months since WR6AMD returned to the air after a two month and five day hiatus. You remember WR6AMD, or rather WR6ABE. It had been abused beyond belief, taken over by a small but inconsiderate group of users who had little or no regard for themselves or anyone else. In desperation, Bob Thornberg WB6JPI had taken the system off the air, restructured its operational parameters, and instituted a rather stringent set of regulations to guide its day-to-day operation. It was to be a "make it or break it" attempt to save a repeater system that had been one of the nation's pioneering efforts in this field. I wrote at that time: "Would it be greeted by a group of enthusiastic people, eager to build a new standard of open format repeater operation, or would the promised vendetta of a selfish few be the key to making WR6ABE go dark forever and perhaps signal the end to open format relay communication elsewhere?"

For all intents and purposes, WR6ABE returned to operation on Wednesday, January 5, 1977, rather than on the first, as promised. They had come on at about 10 am on the first, but went dark again in support of L.A.'s first Repeater Appreciation Week. At about three in the afternoon on the fifth, WR6ABE (now under the callsign WR6AMD) came back to life. The first few days were quiet; I sort of suspected they would be. Repeater Appreciation Week had caught virtually everyone by surprise, and that, not AMD's return, was the main topic of discussion. It started over the weekend — the direct violation of the guidelines to see if JPI and crew really meant business; the jamming of the system with noise, carriers, and at times even music; the mild but noticeable "baiting of the control stations" to see what could be gotten away with. Quickly came the response: first the dropoff of the repeat function, followed by a taped statement that said that in the opinion of the control stations, operation was below the standard set for the system and that a penalty of "x" number of minutes was being exacted. Then came the penalty itself, in the form of system explanation, *QST* bulletins, *HR Report*, etc. The control stations were for real and they did intend to enforce the rules.

It took about two weeks for the control operator baiting to subside; it had been expected and anticipated, and the numerous control stations handled this situation in a way that proved that their choice had been the right one. It did not take long for those who had previously held exclusive title to ABE/AMD's air time to find out that their action would not be tolerated. Soon many lost interest or, as I suspect, did not have the necessary backbone to admit their earlier wrongdoing and outright disappeared. Except for the jamming problem, severe at times, WR6AMD was on its way to becoming a model repeater where good manners and respect for "thy fellow man" was the order of the day. Pride was returning; many old faces were returning; they still return.

Five-thirty weekdays is the time you find out when it all happened in the previous twenty-four hours if you were not around. That's the hour when AMD goes away for a while and is replaced by WA6TDD remote. Bob uses the remote to read a list of the penalties incurred, their duration, and the responsible party. At first many people were put off by this QST — embarrassed, perhaps — but as time has gone on, it has only been the hardcore troublemaker who has been heard to protest. After the first week or so, many of those incurring penalties took the opportunity of this "two-way" QST to express apologies to those they had offended. Yes, indeed, "user abuse" could and was being replaced by "user appreciation and support"; apathy was being replaced with courage. The AMD experiment thus far has been successful; users' attitude adjustment could be accomplished; WR6ABE/WR6AMD could be reborn.

To frustrate jamming attempts, users have been instructed that it is a "major no-no" to acknowledge being jammed, that to do so is to incur the wrath of the control stations. Keeping the system on has to date been far more of a temptation than the acknowledgment of jammers, much to the frustration of those jamming. They could jam, but the audience acknowledgment would not be theirs. Slowly, all but the most dedicated of the jammers either have been caught or have given up in disgust and gone away. After all, it's no fun to jam if you do not get the other guy's goat.

Enter "auto-jam." Around the third week in January, a high speed CW signal appeared at random moments on AMD. How do you T-hunt down a signal that seems to come from everywhere and yet nowhere at the same time? How do you locate a hidden transmitter that operates for about four seconds every ten or fifteen minutes? How, when you think you have located the general area where you think it is, do you pack into some rugged Southern California terrain to locate a needle in a haystack? Sound impossible? Not if you have the tenacity of people like the MWRA T-hunters. It took only three weeks of part-time T-hunting to locate the auto-jam and put it out of service. Actually, it really took about two and a half part-time weekends, for at about three in the afternoon on February 12, Rick WA6VSK literally stumbled over the antenna and proceeded to dig auto-jam out of the ground. It took cooperation, tenacity and an "I-per," but as usual even the most technologically skilled of jamming attempts was again thwarted by some most skilled T-hunters.

Taking on a group of T-hunters as well-trained and skilled as the MWRA group is asking for defeat. A jammer just does not have an even chance. I am convinced that if you hid a transmitter in concrete, threw it to the bottom of the Pacific, and then set out to jam the T-hunters as well, they would not only recover the concrete block, but uncover the identity of the others jamming as well, doing so in record time. I know they can do it; I have seen them take on the roughest assignments and never once be faced with defeat. If it's putting out rf, Rick or someone like him will find it.

The Procrastination Will Get You Everything Department: God bless the ARRL — they never make a mistake. You know what I mean ... like incentive licensing and the like. Now they're making sure not to make another mistake, by involving themselves in any form of national band planning that they cannot completely control from HQ in Newington. At a time when the amateur community needs direction and guidance in this, especially with 21033 looming on the horizon, where is the Newington crowd? The answer, to me, is quite obvious.

When their very own questionnaire proved beyond a shadow of a doubt that the amateur FM community would not be ruled with an iron hand from HQ, when the concept of an ARRL-appointed coordinator for each area was given thumbs down by the majority of us, when ARRL membership was made a necessity for appointment to a coordinator's job, the amateur community was smart enough this time to tell them to get lost. So rather than looking at the input they had gathered and acting accordingly, the good old League took their well-known ostrich approach and spent the past year skillfully dodging the issue. In fact, they still might be in a position to keep dodging if 21033 had not come along. Now, there are a lot of us who will not let them dodge any longer. It's a good number of months now since that matter was returned to committee for further study, and I, for one, want to know exactly where they stand.

Hey, Newington, wake up! The world outside does keep on moving, and if you wait, you are going to find yourselves left out in the cold. We have no intention of having you play God and appoint whom you wish on a political level to run things for us. Many places already have things running quite smoothly, and what we want is liaison with other groups and individuals doing similar work. We do not want any super ARRL-appointed head stepping in from left field to try to tell us how things should be done. You have but two choices: Either provide the necessary liaison between coordinating councils, or step aside so that someone who is more qualified can do your job for you. 21033 has a lot to offer, but it cannot work unless there is total open and ongoing communication and cooperation between those involved in coordination efforts. Next month or next year will be too late. Now is the time that necessitates action, and if you are not going to act as a representative to all amateurs, members and non-members alike, I can assure you that there are others who will be happy to do so without you. If, as you claim, you represent all amateurs, you will find a way to build some structure of national band planning that *represents* the views and needs of *all* amateurs involved in relay communication. It's your obligation to do so!

Unlike the rather normalized form of operation that one finds on the low bands, amateur relay communications is ever changing and seeking new horizons. In the next few years, there might conceivably be "repeaters" on satellites in synchronous orbit providing worldwide HT coverage. The technology of relay communications is ever advancing, and along has come a breed of amateur that has no time or patience for those who procrastinate. Newington, if you have no intention of taking on this formidable job, please make your intentions public now so that those of us who are concerned with the future can start building the framework of something that will forever bind all amateurs together. We realize the real impact of total repeater/remote deregulation, and are prepared to take on the responsibility. Are you?

In the June, 1976, issue of this magazine, I authored an article titled, "A Representative Democratic Republic," which in essence presented a basic structure for a national/international band planning council that gave a voice to virtually every concerned amateur and every special interest group. If you have not read it, back issues are available from *73* at a nominal fee. That's issue #188 for those of you who file numerically. I do not propose or hope to propose that I have all the answers, or that this idea is the ultimate solution to our current and future problems. I do say that it is a fairly well-conceived groundwork, built on your input, and from which the ultimate solution might be obtained (with probably a lot of modification to suit regional needs). If you are truly concerned about the future, please take another look at this article, find its faults, and suggest alternatives. See if it or something like it could be worked into the structure of your area. Feel free to tear it apart word by word and idea by idea, and restructure it. Then let us know where you stand. A year ago when it was published, a small need for something along those lines existed, but 21033 makes that need into a dire one. To date, this has been the only comprehensive band planning attempt yet fielded. I know that there are many of you out there with even better ideas, but unless you put them down on paper and let Wayne Green or myself know exactly what you feel, we can do little except present our own ideas, and hope that they satisfy your needs today and in years to come. If the ARRL feels like procrastinating on this subject, let it. VHF, UHF, FM, and repeaters have always been treated by them as a stepchild,

anyhow. We just might be a lot better off keeping them out of it and for once standing up to be counted for ourselves. I sincerely believe we have that ability at our fingertips — if only we would bury our personal apathy for a few moments to sit down with a pen and express ourselves. 21033 places our destiny in our hands, for better or worse. If it gets to the report and order phase intact, which it conceivably might, then it will open up a Pandora's box that we must be ready to accept and help guide. We at *73* are ready and willing to accept our share of the responsibility. We suspect that those of you reading this feel the same, in that you recognize your share of the burden. This leaves but one unknown entity, the ARRL, and it's anyone's guess as to where it stands.

The 220 Department: How many 220 repeaters are there where you live? Would you believe that here in the southland there are already 35 in operation, of which 25 are open systems? Eighteen others are in test status, and if you count the two channel pairs being held open for Mexico and the 223.00/224.60 repeater test channel, you will note that all 220 channel pairs are assigned (with the majority in day-to-day use). In the two and a half years since Bill DuHaime WA6NTW placed the first 220 FM system into operation, 220 has grown to a point where it is starting to approach the 146 MHz spectrum crunch.

How crowded is 220 really getting out here? There are times of the day when 223.5 is as crowded as .52 or .94 on two, and if the growth of this spectrum continues at its present pace, we might have to consider 10 kHz (shudder) splits in the foreseeable future. Let's put it this way: We are doing our part out here to thwart any attempt at 220 MHz Class E CB. If you have the activity level we have, then you have done your part, too. If not ... what are you waiting for? Remember our motto: "220 — USE IT OR LOSE IT!"

The Six Meter Department and Other Things: Six meters for the most part is still a veritable wasteland FM-wise. As you are probably aware, our local council that coordinates six, 450, and above is diametrically opposed to the band plan dictates of Newington, and has adopted and implemented its own coordination plan for six meters. Rather than the 1 MHz ARRL plan, SCRBBA coordinates on what they feel to be a far more technologically competent 220 kHz plan. However, it's the same old TVI bugaboo that instills fear into the hearts of many a potential six meterite that I consider the prime reason for the lack of activity on six (rather than any band plan conflict). By the way, SCRBBA is anxious to share their views and technology with those interested, and an SASE to the Southern California Repeater and Remote Base Association, PO Box 5967, Pasadena CA 91109, may well bring some rather interesting reading material. In fact, whenever you write anyone listed herein for info, I suggest including an SASE to help defray costs to these organizations and individuals. Especially with the cost of postage these days!

Interest in UHF fast scan ATV is growing, as is the membership of the Southern California ATV Club. With better than sixty members, plans are in the works for a crossband 450 to 1250 ATV repeater for this area — possibly from Mt. Wilson. The crossband mode was selected so as to cause an absolute minimum of problems to adjacent narrow band voice communication, which is the prime communication mode on that band in this area. No date has yet been announced as to when this project will be completed, but it is hoped that by repeating 450 to 1250, ATV and narrow band FM will be able to totally coexist and at the same time interest ATVers in experimenting with this mode on bands other than just 450. Input will be in the same 435-plus area as well as other ATV systems, but output has yet to be pinned down specifically. An SASE to the SOCAL ATV Club should bring some info as to what they are doing and what their plans are. The address is So. Calif. ATV Club, c/o John Ruckert WB6ZPN, Secretary, or Ernie Williams WA6BAP, President; both are good in the callbook.

The Sears and the Two Meter Radio Department: OK, guys and gals. Why all the huff? What is the difference between going to your favorite radio emporium or to Sears, Roebuck and Company to buy a two meter radio? Why is it OK to mail order such a piece of equipment from a dealer in another city, but a no-no for a company with the high credibility factor of the Sears organization to even consider selling equipment for that which we hold so dear? Are we starting to run scared of our own shadows?

I, for one, cannot accept this double standard for a number of reasons. First, the rampant paranoia that says Sears selling two meter equipment will put my radios into the hands of those not licensed is totally ridiculous! Has any salesman in any radio store ever asked you to present your license before he sold you a rig? It's never happened to me. If a person intends to get hold of a piece of amateur equipment for illegal use, it won't matter where he goes to buy it. There is no law that states that one must have a valid license to own a piece of amateur transmitting equipment — only to use it. If a person is going to violate the amateur rules and regulations, then it really makes no difference who sells him the radio, does it?

Secondly, how many advertisements carry a specific disclaimer stating that a specific minimum grade of amateur license is required to operate such equipment? The Sears advertisement in the spring/summer catalog, page 967, sure does. It spells it out in very specific terms that anyone can understand. It states specifically that a Technician, General, Advanced or Extra grade license is required prior to transmitting with the unit. Score one for Sears! Again, this goes along with the very high operating standards that the Sears organization adheres to, standards that have made Sears the world's most respected mass merchandiser.

Then, too, there is the most important aspect of this move by Sears back into the amateur radio marketplace. To me, it signals a rather bright future for the overall amateur equipment market. Remember, Sears did not get to the position it holds in the mass merchandising marketplace by making mistakes. They are at the top because they have good business sense. They see what I see: a new and substantial growth period for the amateur service. They are willing to take on the sale of amateur equipment once again. To me that says we are well on the way to what many of us have been working toward for the past two years: an unexcelled overall growth in the number of licensed amateurs (resulting in the increased numbers we will need to hold our own at the 1979 WARC in Geneva).

There are a few other good points that some of you might not be aware of in relation to Sears. First is the fact that Sears services what they sell, so amateur radio will be enjoying something it never had before. The ease of obtaining the necessary parts and service should a rig run amok some day. How easy? As easy as locating the nearest Sears service center or catalog store. Sears happens to run the world's largest organization, and they are located everywhere. In fact, they're only a phone call away. Have you any idea what having this type of service backing a product means?

Then, too, there is the basic creed of the Sears Roebuck organization — which is the simple policy of "Satisfaction Guaranteed or Your Money Back." This is a policy that is fol-

Oscar Orbits

Oscar 6 Orbital Information					Oscar 7 Orbital Information			
Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W	Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W
NA 20766 BTN	1	0005:39	62.1	11242 A	1	0112:06	71.0
N 20779	2	0100:35	75.8	11254 BQ	2	0011:27	55.9
NA 20791 BTN	3	0000:31	60.8	11267 A	3	0105:44	69.4
NA 20804 BTN	4	0055:27	74.6	11279 BX	4	0005:05	54.3
N 20817	5	0150:22	88.3	11292 A	5	0059:22	67.9
NA 20829 BTN	6	0050:18	73.3	11305 B	6	0153:39	81.5
N 20842	7	0145:14	87.1	11317 A	7	0052:56	66.3
NA 20854 BTN	8	0045:10	72.1	11330 B	8	0147:17	79.9
N 20867	9	0140:06	85.8	11342 A	9	0046:37	64.7
NA 20879 BTN	10	0040:02	70.8	11355 B	10	0140:54	78.3
NA 20892 BTN	11	0134:57	84.6	11367 AX	11	0040:15	63.1
N 20904	12	0034:53	69.6	11380 B	12	0134:32	76.7
NA 20917 BTN	13	0129:49	83.3	11392 A	13	0033:52	61.6
N 20929	14	0029:45	68.3	11405 B	14	0128:10	75.2
NA 20942 BTN	15	0124:40	82.1	11417 A	15	0027:30	60.0
N 20954	16	0024:36	67.1	11430 BQ	16	0121:47	73.6
NA 20967 BTN	17	0119:32	80.8	11442 A	17	0021:08	58.4
NA 20979 BTN	18	0019:28	65.8	11455 BX	18	0115:25	72.0
N 20992	19	0114:24	79.6	11467 A	19	0014:45	56.8
NA 21004 BTN	20	0014:20	64.6	11480 B	20	0109:03	70.4
N 21017	21	0109:15	78.3	11492 A	21	0008:23	55.3
NA 21029 BTN	22	0009:11	63.3	11505 B	22	0102:40	68.9
N 21042	23	0104:07	77.1	11517 A	23	0002:01	53.7
NA 21054 BTN	24	0004:03	62.1	11530 B	24	0056:18	67.3
NA 21067 BTN	25	0058:59	75.8	11543 AX	25	0150:35	80.9
N 21080	26	0153:54	89.6	11555 B	26	0049:56	66.7
NA 21092 BTN	27	0053:50	74.6	11568 A	27	0144:13	79.3
N 21105	28	0148:46	88.3	11580 B	28	0043:33	64.1
NA 21117 BTN	29	0048:42	73.3	11593 A	29	0137:50	77.7
N 21130	30	0143:37	87.1	11605 BQ	30	0037:11	62.6
NA 21142 BTN	31	0043:33	72.1	11618 A	31	0131:28	76.1

The listed data tells you the time and place OSCAR crosses the equator in an ascending orbit for the first time each day. To calculate successive orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the first crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world, it will descend over you. To find the equatorial descending longitude, subtract 166 degrees from the ascending longitude. To find the time it passes the north pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR when it is within 45 degrees of you. The easiest way to do this is to take a globe and draw a circle with a radius of 2480 miles (4000 kilometers) from the home QTH. If it passes right overhead, you should be able to hear it for about 24 minutes total. OSCAR will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15 degrees from you, add another minute; at 30 degrees, three minutes; at 45 degrees, ten minutes.

OSCAR 6: Input 145.85-145.95 MHz; Output 145.90-146.00 MHz; Output 29.45-29.55 MHz; Telemetry beacon at 29.45 MHz.
OSCAR 7 Mode A: Input 29.40-29.50 MHz. Mode B: Input 432.125-432.175 MHz; Output 145.925-145.975 MHz.

Orbits designated "X" are closed to general use. "ED" are for educational use. "BTN" orbits contain news bulletins. "Q" orbits have a ten Watt erp limit. "L" indicates link orbit. "N" or "S" indicates that Oscar 6 is available *only* on northbound or southbound passes. Satellites are not available to users on "NA" days.

lowed by all Sears stores and service centers. Few others offer that or anything near it. In today's marketplace such a policy is unheard of, yet Sears lives with it and by it.

So before writing all those letters to Wayne Green and the rest of the staff protesting about Sears or any other large retail chain selling amateur equipment, sit down and think for a moment. If you do, you might realize as I do that Sears re-entering the amateur radio marketplace is really a sign of good times ahead. We need Sears and anyone else who is willing to involve themselves in such a righteous manner. In fact, if everyone lived up to the high marketing standards of Sears, we would have little to worry about.

The WR6AKG Department: Well, friends, as I write this, the first amateur repeater devoted primarily to this city's school children has become a reality. About 24 hours ago, Keith Glispie WA6TFD, its builder/backer, "through the big switch" and two meters, had a new form of amateur repeater born here in the southland. While credit for the very inception of AKG goes directly to Keith and those who worked with him on the project, one must not forget that it was a cooperative effort also involving the Dorsey High Amateur Radio Team, the Southern California Repeater Association (with Bob Thornberg WB6JPI, its chairman, and Jim Hendershot WA6VQP, of its two meter technical committee), and the people of the Los Angeles Unified School District. It was a cooperative effort across the board, and in my opinion each of the groups involved must be given proper recognition for the part that it played.

Though AKG is on the air at last, it is in what we term "test status," and has yet to move into its permanent home atop the Baldwin Hills. In the meantime, there are still a few kinks to iron out, including that of a RACES group that let it be known that Keith's input was their RACES channel only after AKG went on the air. With all the pre-publicity that AKG garnered here and elsewhere long before it ever came on the air, and with the actual channel pair published in this column a few months back, I am at a loss to explain why the RACES group waited until after AKG went into operation before letting anyone know that they were using the channel. However, I feel that this should be easy to solve, in that either the two can coexist (perhaps with the RACES group using the AKG facilities for its drills and operations) or an operational schedule can be arranged to meet the needs of both. However, the most important step is to get the RACES people and the AKG people sitting down over a cup of coffee for a good rap session. It never fails to amaze me what can be accomplished once people, even hams, learn the art of personal communication. However, it should be noted that such incidents as this could easily be avoided by having non-relay special interest organizations such as RACES groups, AREC (ARPSC) groups, and the like attend and take an active part in the many open meetings held by local repeater and FM councils (such as SCRA and SCRBBA). There is absolutely no way for any coordinating council to know if a channel is in use by a non-relay special interest group unless that group makes an effort to let the rest of the world know it exists. I must ask if it is really that hard for a non-relay group to find a warm body or two who are willing to attend such meetings so as to initiate good ongoing communication with the rest of those using the spectrum. Only such cooperation and communication can avert a reoccurrence of this unfortunate happening. I can speak for the SCRA when I tell you that not only are their quarterly meetings open to all interested amateurs, but also that they invite those truly interested but who are not repeater owners to become active in the organization by obtaining associate membership. They invite open dialogue between repeater owners, users, and other non-relay special interest groups, as they realize that it is only through such dialogue that all spectrum users can benefit.

Anyhow, that really does it for the AKG story: from the idea of an ex-high school student who saw a need to a service to the younger generation of Los Angeles amateur operators. We have all been a part of amateur radio history; we have watched it develop from the embryo of an idea to the reality of today. We can all take pride in the corps of devoted citizens, amateur and non-amateur alike, who worked shoulder to shoulder to give repeater communication a truly new meaning and direction. Looking West salutes them all.

Repeater Update

Compiled by Stan Miastkowski WA1UMV

CALIFORNIA

WR6AWZ	Ridgecrest	146.76	No squelch tail
WR6ABA	LA Mt. Washington	147.71	Delete
WR6ABC	Los Angeles	224.36	Delete
WR6ABI	Los Angeles	147.00	Delete
WR6ABQ	Los Angeles	147.27	Delete
WR6ABR	Los Angeles	147.12	Delete
WR6ABU	Los Angeles	147.06	Delete
WR6ACA	LA Saddle Pk	146.70	Delete
WR6ACT	Barstow	146.76	Delete
WR6ADO	Orange County	146.895	Delete
WR6AEP	Ventura	146.88	Delete
WR6AEP	Ventura	147.325	Delete
WR6AEY	June Lake	146.61	Delete
WR6AEY	June Lake	224.14	Delete
WR6AFC	Thousand Oaks	224.10	Delete
WR6AFZ	Redding	146.76	Delete
WR6AGH	Ventura Hall Canyon	146.73	Delete
WR6AGH	Ventura Hall Canyon	224.06	Delete
WR6AHF	Newberry Park	147.67	Delete
WR6AHF	Newberry Park	224.74	Delete
WR6AHR	San Diego	147.825	Delete
WR6AIP	San Diego	147.885	Delete
WR6AJX	San Diego	146.91	Delete
WR6ABW	Los Angeles	147.00	Delete

COLORADO

WR0AFC	Grand Junction	146.64	

ILLINOIS

WR9ALB	Mt Prospect	147.255	
WR9AGQ	Chicago	224.78	AP

INDIANA

WR9	Frankfort	146.61	WX/AP

IOWA

WR0	Boone	147.39	
WR0AGJ	Cedar Rapids	146.70	RTTY
WR0ALW	Cedar Rapids	224.94	
WR0ALF	Clear Lake	147.00	Private

LOUISIANA

WR5ADV	De Ridder	146.85	

MASSACHUSETTS

WR1AAI	Quincy	224.02	
WR1ATE	Somerville	224.18	
WR1AFP	Fitchburg	224.34	IN/222.74
WR1AGP	Medway	224.66	DX Alert
WR1ABV	Waltham	224.94	

MAINE

WR1AHQ	Presque Isle	146.73	

NEW HAMPSHIRE

WR1AIL	Chester	224.46	DX Alert

NEW JERSEY

WR2AEU	Lawrenceville	224.30	AP
WR2	Montclair	29.64	IN 29.54

OHIO

WR8ALW	Belle Fountain	147.60	IN 147.00

PENNSYLVANIA

WR3AIV	Oil City	147.12	

TEXAS

WR5ACJ	El Paso	146.70	
WR5	El Paso	146.88	VOX/any TT
WR5ANL	Austin	52.525	
WR5ASC	Austin	146.94	
WR5ACY	Austin	146.88	
WR5ALM	Austin	146.79	AP
WR5ACQ	Austin	444.10	Private

WISCONSIN

WR9AFC	Platteville	146.82	Autopatch
WR9AKA	Milwaukee	223.94	222.34 IN

CANADA

VE3GOD	Goderich ON	147.03	146.43 IN
VE3TTT	London ON	147.00	Autopatch

JORDAN

JY73	Amman	145.70	

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The Rotor everyone has been waiting years for — capable of the largest arrays up to 40 sq. ft. –Superior to prop-pitches — Full 4,000 inch lbs. of turning torque. Braking system requires 12,000 inch lbs. before over-riding — accepts 2" - 3" masts — Weighs 60 lbs. — Size: 11" diameter, 19" high.

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In addition, a Special Braking System requires 1300 inch lbs. of torque before windmilling— This is more than twice the breking ability of the other comparable rotor being marketed.

Full 9/8 Steel Ball Bearing raceway assures elimination of side torque jamming when Rotor is mounted in line with the mast.

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Model No.	Frequency	Forward Gain (dB)	Front-to Back Ratio (dB)	Front-to Side Ratio (dB)	Boom Length (ft.)	Number Elements	Longest Element (ft.)	Turning Radius (ft.)	Surface Area (sq. ft.)	Wind Loading at 80 MPH (lbs.)	Assembled Weight (lbs.)	Shipping Weight (lbs.)	Price
M340	40	8.5	20	30	40	3	70'0"	36'0"	10	280	160	220	$349.00
M820	20	13.0	28	35	52	6	36'0"	32'0"	10.5	210	90	123	499.00
M820	20	12.0	26	30	46	5	36'6"	27'9"	8.75	175	74	98	399.00
M204	20	10.0	25	30	26	4	30'4"	22'6"	6.8	136	42	46	199.00
M203	20	8.5	20	30	16	3	30'6"	20'0"	5.53	105	30	40	129.00
M155	15	12.0	26	30	26	5	34'2"	16'3"	5.0	100	41	44	159.00
M154	15	10.0	25	30	16	4	24'3"	16'0"	4.0	80	30	33	139.00
M153	15	8.5	20	30	12	3	24'2"	14'0"	3.0	60	21	24	89.00
M108	10	13.5	28	30	45	8	16'0"	22'0"	5.5	110	60	77	219.00
M106	10	13.0	28	30	31	6	16'0"	16'1"	4.0	80	34	39	119.00
M105	10	12.0	26	30	26	5	16'0"	13'3"	3.5	68	28	33	109.00
M103	10	8.5	20	30	11½	3	16'6"	10'0"	2.0	40	10	14	39.00
DB54	20	12.0	26	30	46	5	30'4"	27'0"	12.75	255	94	110	349.00
	15	10.0	25	30		4	24'3"						
DB43	15	8.5	20	30	16	4	24'3"	16'6"	6.0	150	34	43	149.00
	10	10.0	25	30		3	16'6"						
DB33	15	8.5	20	30	11	3	24'3"	16'2"	4.0	80	26	33	109.00
	10	8.5	20	30		3	16'6"						

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W2

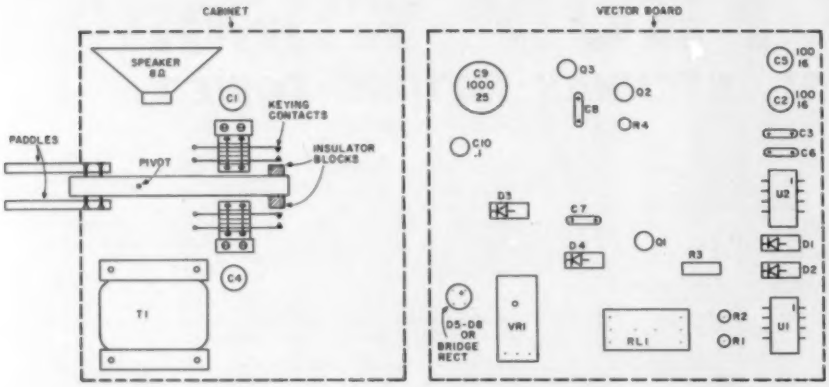

Fig. 1. R1, R2 – 330 Ohm, ¼ Watt; R3 – 10k, ¼ Watt; R4 – 56k, ¼ Watt; C1, C2, C4, C5 – 100 uF, 16 V electrolytic; C3, C6 – .01 uF; C7, C10 – .1 uF; C8 – .05 uF; C9 – 1000 uF, 25 V electrolytic; RA, RD – 1k linear taper pot; RB – 500 Ohm linear taper pot; RC – 10k linear taper pot; D1-D8 – 1N4004 or equivalent 400 V piv, 1 Amp; Q1, Q2 – 2N2222 NPN; Q3 – 2N5964 PNP; RL1 – 12 V reed relay; VR1 – 12 V positive regulator #7812; T1 – any 15 or 20 V power transformer 500 mA or more.

This keyer is simple and inexpensive to build. The NE555 timers will cost .50 to $1.50 each depending on the source of supply. Your local Radio Shack calls it a 276-1723 and will charge you $1.49. If you like, you can use a dual timer called a 556 (Radio Shack 276-1728). The only difference will be that both timers are in one package and V+ and V- connections are common to both timers. See the specs that come with your IC for pin connections. All other components can probably be found in your junk box. The keyer has no memories but the characters are self-completing and are fully adjustable not only in speed, but length of character as well. The key must be two

Build the World's Simplest Keyer

- - uses 555 timers

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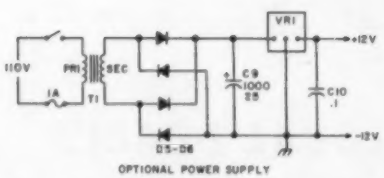

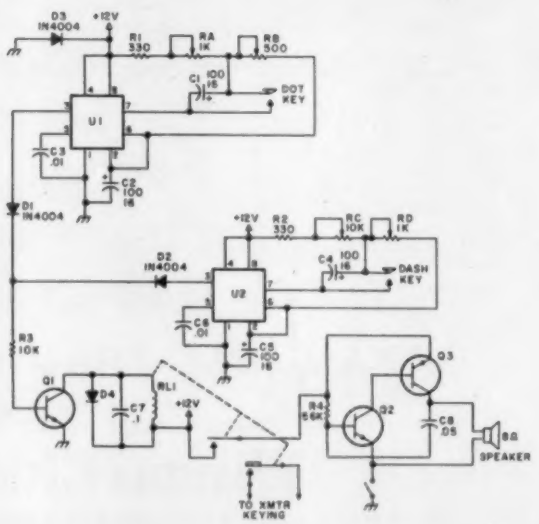

Fig. 2. T1 – 15 to 20 V sec at 500 mA; D1-D8 – 1N4004; VR1 – #7812 12 V 1A positive regulator; U1, U2 – NE555 timer IC; RL1 – 12 V reed relay DPST; Q1, Q2 – 2N2222; Q3 – 2N5964; all resistors ¼ Watt.

SPST switches. The standard SPDT key will not work.

How It Works

When the dot key is closed, U1 becomes an astable multivibrator. The speed of the multivibrator is determined by RB, and the duty cycle or length of the dot is determined by RA. When U1 is turned on, pin number 3 is high, causing Q1 to turn on and close relay RL1. D1 and D2 are necessary because when U1 is high, U2 is low, so pin 3 of U1 must not be tied directly to pin 3 of U2. Most reed relays available on the surplus market today are 3 pole single throw. One set of contacts is used to drive the monitor oscillator consisting of Q2 and Q3, while one or both of the remaining contacts (2 wired in parallel will handle more current and is more reliable) are used to key the transmitter. The operation of U2 is identical to U1 except the timing and length of character.

Construction

There are no special construction considerations except the key as mentioned earlier. I constructed mine on a 2" x 4" piece of vectorboard with .1 inch spacing. This is available at Radio Shack also and can be purchased in several different sizes and cut to desired size with tin snips. The whole keyer is constructed in a 2½" x 5" x 6" box. The 12 volt supply may be taken from your transmitter or the power supply shown may be used with all except the transformer mounted right on the vectorboard. There is ample room in the box for a small 15 to 20 volt transformer. 400 or 500 mA will be sufficient as the keyer draws only approximately 50 mA key closed. A push-button switch is provided to shut off the monitor in case your transmitter has a sidetone monitor of its own. ■

Rick Bourgeois, M.D. WA5EVH
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Stop That Autostart

- - mods for the ST-6 circuit

The ST-6 autostart is nice when used in the amateur bands, but doesn't help much when one wants to copy commercial stations that do not drop their carriers when not transmitting any text. As long as there is a mark tone, the ST-6 stays in receive with the motor on. Mechanical motor stops work okay except in noisy conditions. Since the ST-6 stays in receive with a steady mark, any fading or noise keys the loop and the mechanical motor stops just cycle off and on.

However, the circuit shown in Fig. 1 solves the problem.

How It Works

The versatile 555 IC timer is the heart of the circuit. The timer output, pin 3, goes to the input of the ST-6 op amp 5 (OA-5). Normally during receive, pin 3 is high and blocked by D1 so that nothing happens. While RTTY is being received, trigger pin 2 of the IC is drawn low through D2 and starts the timer, but C1 is also kept discharged by this same line through D3 and the switching action of Q1. This prevents C1 from charging and the timer output stays high. Once FSK reception stops, however, and a steady mark tone remains, C1 is allowed to charge up. After a predetermined interval, pin 3 drops to low; this pulls the input of OA-5 low, effectively mimicking a loss of signal condition.

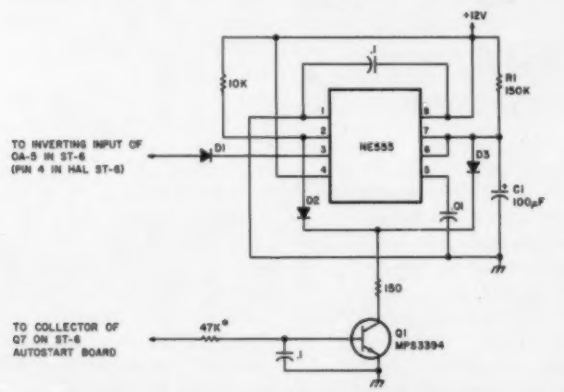


*Fig. 1. Time delay (in secs.) = 1.1 x R1 (Ohms) x C1 (farads). *Increase to 56k if Antispace fails to operate.*

The ST-6 now goes into standby and the regular "motor off" function occurs as usual. The motor remains off until valid RTTY again appears. Note that no previous function of the ST-6 has been compromised, but now the ST-6 goes into standby and the subsequent "motor off" condition with a steady mark as well as with a loss of signal condition. A time of 15 seconds works well, since this, added to the 25 seconds of the ST-6 delay, gives about 40 seconds to turnoff in the presence of a steady mark. An additional added benefit is that the ST-6 now can screen the signal for the presence of valid RTTY before the motor again turns on.

The circuit can be built on a small PC board, and is mounted directly onto the ST-6 Autostart/Antispace board. Only three connections other than ground are required.

If you spend much time copying things like the weather and press, do your printer a favor and give it a rest with this nifty little circuit added to your ST-6. ■

Predict the Weather!

- - a complete satellite receiver

Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

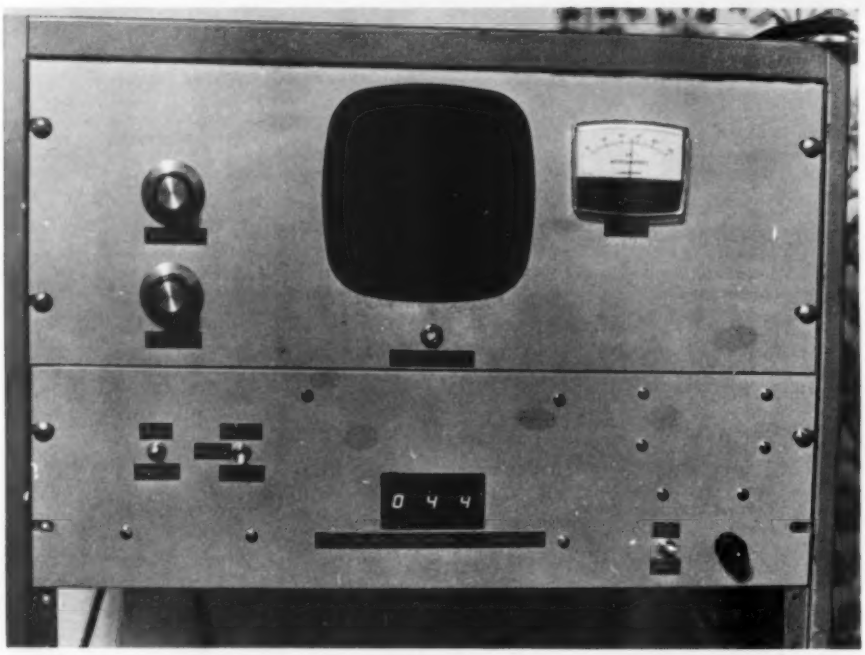


Fig. 1. The author's satellite receiver. The RX-144 modules are mounted in a minibox with the squelch and volume controls on one end. The box is mounted on its side behind the rack panel, secured to the panel by the control nuts of the volume and squelch controls. The signal strength meter and speaker plug into phono jacks at the other end of the minibox. Two other jacks on the same end of the box provide for the 12 volt input and the low level output to the tape recorder. The BNC receptacle is also located on the exposed end of the minibox. The headphone jack illustrated is optional, but does help keep the rest of the family asleep during early morning satellite transmissions. A shorting ¼ inch phone jack in the speaker line is all that is required. The panel below the receiver contains a rack mounted version of the digital orbital timer described previously in 73 *and also in the* Weather Satellite Handbook. *The timer is programmed for NOAA 4 which was 44 minutes into an orbit when the photo was taken. Since the photo was taken in the morning, the satellite should have been audible on the receiver. If the photo reproduces well, you can see from the signal level meter that indeed it was!*

One of the most important pieces of equipment in the weather satellite station is the receiver that actually picks up the satellite transmissions. The *Weather Satellite Handbook* (available for $4.95 from *73*) outlines several approaches to the receiver portion of the station, including custom receivers available "off the shelf," modification of commercial monitor receivers, availability of kits, and conversion and utilization of surplus equipment. The purpose of this article is to describe the construction of a complete satellite receiver using a readily available kit. Before we start on the details, however, it would be useful

to briefly review the desired characteristics of receivers for satellite service. These characteristics involve mode and bandwidth requirements, sensitivity, frequencies, and various operating conveniences that complement the operation of the satellite station. I will briefly outline some of these requirements and then show how the typical home brew addict can achieve the desired performance.

Frequencies

Two frequency ranges are currently in use for various weather satellite operations – the 135-138 MHz VHF satellite band and the 1691 MHz S band frequency used by the new series of GOES geostationary satellites. If operation in both frequency ranges is contemplated, the logical approach is to begin with a quality VHF receiver and add on the S band capability in the form of a converter. As noted in a previous review article, the S band converter problem is a hard nut to crack, but there are some exciting developments afoot in this area and you can count on the fact that *73* will carry the details on a suitable converter once the system is to the point where it can be readily reproduced. In this article, we will describe a basic VHF receiver which is packaged so the S band converter can be added at a later time.

In the VHF range we are interested in three different frequencies:

135.6 MHz – the ATS geostationary satellites transmitting gridded WEFAX pictures in the APT mode

137.5 MHz – primary frequency for the NOAA polar orbiting satellites transmitting real-time visible light and IR pictures in the 48 line SR mode

137.62 MHz – used once a month for tests with the primary NOAA spacecraft and as the primary frequency for any backup NOAA satellites that are still operational

To insure on-frequency operation when needed, the receiver should be crystal controlled. It may be single channel if your operations involve primarily the ATS or NOAA spacecraft (i.e., 135.6 or 137.5 MHz) or it can be multi-channel with switch selection of all of these frequencies. Since this frequency range is quite close to the two meter band, there should be some useful possibilities for conversion of two meter receiver designs, something we shall take advantage of in constructing the receiver to be described shortly.

Mode and Bandwidth Requirements

The satellite transmissions of interest to us are all FM with a deviation of 9-10 kHz. This means that the basic receiver should have a bandwidth of at least 20 kHz (10 kHz selectivity) in order to accommodate the satellite signal. In the case of the polar orbiting satellites, we have an additional factor to consider – Doppler shift as the satellite approaches and moves away from the ground station. In the case of the VHF satellite range, this Doppler shift is in the order of ± 4.5 kHz. Given worst case Doppler and maximum deviation, we would thus require a bandwidth of 30 kHz (15 kHz selectivity) for a general purpose satellite receiver. This is fortunate, since i-f filters for 30 kHz bandwidth are readily available although no longer standard for most receivers. Most VHF FM operation today is standardized at 15 kHz bandwidth (7.5 kHz selectivity). This is too narrow even to accommodate the deviation of the geostationary satellites, let alone deviation and Doppler shift in the case of the polar orbiters. If such a narrow filter is used, the upper part of the deviation swing will fall out of the

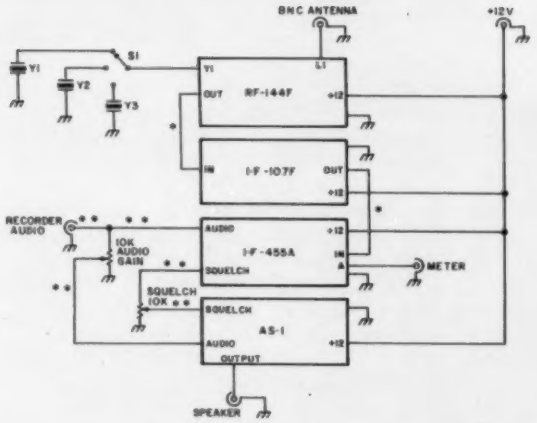


*Fig. 2. Schematic representation of the interconnection of the receiver circuit boards. The kit instructions show the actual location on the boards for each of the connections noted above. The connection between L1 on the RF-144F board and the BNC connector is made with a very short length of the silver-plated wire supplied with the kit. Mounting of the individual boards should assure adequate grounding of each board to the aluminum minibox. Rf connections between boards (marked with *) should be made with the shortest possible lengths of miniature 50 Ohm coax. Connections to the audio gain and squelch controls (marked **) should be made with shielded audio cable. All other connections can be made with ordinary hookup wire. In the case of a muiti-channel receiver, the wire from Y1 of RF-144F should be routed to the common lug of the crystal selector switch (S1). One lug of each of the three crystals (Y1 – 135.6, Y2 – 137.5, Y3 – 137.62) can be soldered to the switch lugs. The other lug of each crystal can be routed to a common ground connection using the shortest possible leads.*

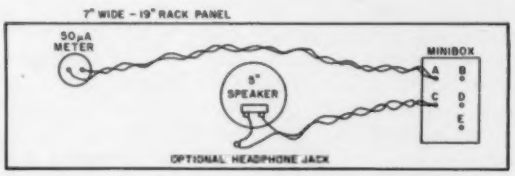
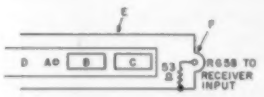


Fig. 3. Diagrammatic representation of the interconnection of the receiver elements on the rack panel. The aluminum minibox with the receiver boards mounts to the panel using the control nuts for the squelch and volume controls. The rear of the minibox contains the four phono jacks (A-D). A is the meter output and connects to the 50 microamp meter on the front panel. The meter leads terminate in a phono plug with the + lead on the center pin and the - lead to the grounded shell. B is the low level recorder output and connects to the tape recorder input with a shielded audio cable. C is the speaker output. Leads from the 5 inch speaker are mated here with a phono plug. If a headphone jack is desired, a ¼" phone jack can be wired into the hot speaker lead – a shorting jack should be used so the speaker is operative when the headphone plug is removed. D is the +12 V plug and is connected to the 12 V receiver supply – +12 V to the center pin of the phono plug and the - lead to the outer shell. E is the BNC connector for the antenna. Ample space remains behind the panel for later incorporation of an S band converter and switching circuits.

Fig. 4. Diagram of a variable strength 137.5 MHz signal source for receiver alignment. A — SPST toggle switch controlling power to the oscillator; B — 9 V transistor battery; and C — an OX oscillator with a type EX crystal on 45.833 MHz. A, B, and C are attached to the end of a wooden ruler or yardstick (D) which slides in and out of a copper tube (E) with a diameter sufficient to clear the oscillator module. Two feet of tubing is adequate. A coax jack (F) is mounted to a copper or brass partition soldered across the end of the tube, terminated with a 53 Ohm resistor. 52 Ohm coax connects this jack with the receiver input. The signal level of the source can be varied by sliding the oscillator in and out of the tube. Signal level to the receiver will increase as the oscillator is moved toward the pickup end of the tube and will drop as it is moved away. If the receiver is built as a single channel unit for 135.6 MHz ATS satellite service, a 45.200 MHz crystal in the OX oscillator will provide harmonic output on the proper frequency.



receiver passband. In the case of the polar orbiters, you would lose the upper end of the gray scale even when the satellite was overhead, and the signal would be virtually impossible to copy early and late in the pass when Doppler shift would slide most of the signal out of the narrow receiver passband.

Other Features

Since most stations make recordings of satellite transmissions, an audio output connection for this purpose is desirable. Ideally, this tap should be made before the volume control so that changes in speaker listening level do not result in changes in record level. If the receiver has a squelch control (desirable to prevent operator insanity when a satellite is not within range), this feature will also permit continuous recording even if the squelch control cuts in and out due to a tight setting. A front panel signal strength meter is also desirable to help in antenna tracking. The receiver ac supply should have virtually no ac ripple to prevent incorporation of undesirable ac hum on the recorded or real-time satellite signal.

In making the decision to buy, modify, or build in acquiring a suitable receiver, you should be guided by your own inclinations. Building will probably not save you much money, but it will provide you with a receiver with all features tailored to your own needs. After a traumatic move to a new house, I made the decision to convert my sprawling station to a neat cosmetic installation in a desktop rack. Since none of the receivers on hand lent themselves to rack mounting, I decided to roll my own. While strolling about the Dayton Hamvention with the other satellite and SSTV fanatics, I decided to plow some of my ill-gotten gains from the sale of some equipment into the purchase of a VHF Engineering receiver kit for two meter FM. I vowed to use the kit as the basis for the VHF satellite receiver with all of the features I required, leaving enough space to add the S band converter that was already under development. The effort was an unqualified success and really very little effort at all. If you still like to heat up a soldering iron and want a receiver equal to or better than anything you can buy, then read on and discover how it can be done.

THE RX-144 RECEIVER KIT

The heart of the receiver is the RX-144 kit available from VHF Engineering, 320 Water Street, Binghamton NY 13902, for $69.95. Given the performance of the completed receiver, this has to be one of the finest values in the amateur radio market today! Their standard RX-144C kit contains boards and parts for the following sub-assemblies:

(1) RF-144F front end board, providing a crystal controlled front end with 10.7 MHz i-f output. Dual gate MOSFETs are used for the rf amp (MPF-121) and mixer (MPF-122). Squelch sensitivity is rated at 0.2-0.3 microvolts but appears to be slightly better in the "real world." Front end gain is approximately 40 dB with 55 dB of image rejection and 100 dB of i-f rejection.

(2) IF-10.7F board providing two stages of 10.7 MHz i-f amplification using ICs with output at 455 kHz. An input crystal filter (2 pole) sets the system bandwidth. Total gain is in the order of 50 dB and the circuit is unconditionally stable.

(3) FM-455A board with a single IC 455 kHz amplifier providing 30 dB of gain and an IC limiter and FM detector. The board has provisions for a signal strength meter and a zero-center discriminator meter.

(4) AS-1 board, providing squelch and COR functions as well as up to 2 Watts of audio amplification for operation of an external speaker.

In order to build the receiver as described, you will require the additional components listed in Table 1. Some of these relate to the specific packaging scheme which I employed, so you can obviously alter these to suit your own needs. The basic kit is packaged as four individual units, each containing a circuit board and the proper components, as well as a set of layout diagrams, schematics, and instructions for construction and testing of each board. In addition, the kit contains a very complete manual. Where appropriate, departures from kit assembly instructions or additions will be noted for each board.

RF-144F: If the receiver is to be operated on only one channel, the kit instructions should be followed. If multiple channel operation is intended, leave off the socket for the local oscillator crystal (Y1) and solder a length of hookup wire (insulated) to the ungrounded land at the socket location. If the receiver is to be packaged as described later, the input terminal and antenna tap can be omitted at this stage in construction.

IF-10.7F: This board should be wired according to the kit instructions except for the input crystal filter. The filter supplied with the kit is a Piezo Technology 2195F with a bandwidth of 15 kHz. In order to accommodate signal deviation and Doppler shift in satellite service, a bandwidth of 30 kHz is required. The crystal filter specified in Table 1, a Piezo Technology 2196F, has the required bandwidth and should be substituted for the unit included with the kit.

FM-455A: Wire according to kit instructions.

AS-1: Wire according to kit instructions.

When all the boards have been completed, make the usual checks for wiring errors. In case you are tempted to simply bypass the latter step, I will confess that I initially left out a jumper on the 10.7 MHz i-f board and spent several evenings attempting to discover why the receiver wouldn't work!

Fig. 2 shows the basic packaging of the three boards in the minibox specified in Table 1. The boards are oriented cross-wise in the box with the rf board to the rear, followed by the 10.7, 455, and audio boards moving toward the front of the box. The back of the box contains

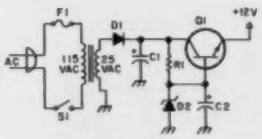
the BNC antenna connector, mounted so that the antenna input tap to L1 of the rf board can be made with a very short length of the silver-plated wire supplied with the kit. The back also contains the 4 phono jacks for the speaker output, +12 V, the S meter output, and the low level audio output to the tape recorder. The front of the box has the squelch and audio gain controls. If you desire multi-channel operation, the crystal selector switch should also be mounted on the front of the box. Fig. 3 summarizes the board interconnections and the connections to the minibox mounted components.

Preliminary Setup

Once the receiver is packaged in the minibox, you are ready for initial checkout and alignment. Connect an 8 Ohm speaker to the SPEAKER jack, the 50 microamp meter to the METER jack, and a 12 volt supply to the +12 V jack. If a calibrated signal generator is available, it can be connected to the antenna input. Applying power should result in typical FM receiver noise output from the speaker. Check the gain and squelch controls for proper operation. Switch S1 to 137.5 MHz and dial up the signal generator to that frequency. The receiver should now quiet. Adjust the signal level so that it drops down to the margin of audibility and proceed to align the rf and i-f boards according to the kit instructions. The name of the game is to keep the signal level down near the noise and keep tweaking for maximum quieting and/or maximum signal level on the meter. What do you do if you can't beg, borrow, or steal a suitable signal generator? The answer is to order a type OX oscillator module with a matching EX crystal from International Crystal Manufacturing Company, 10 N. Lee, Oklahoma City, Oklahoma 73102. The OX oscillator kit and EX crystal for 45.833 MHz will set you back a total of $6.90 for an excellent 137.5 MHz signal source. The problem of keeping the signal level down far enough for alignment can be solved by strapping the oscillator and a 9 V battery to the end of a ruler or yardstick and sticking the whole business into a length of copper tube as indicated in Fig. 4. The tube acts as a waveguide with almost infinite attenuation after several inches. By moving the oscillator toward or away from the pickup end of the tube, you can smoothly vary the signal level to the receiver for alignment purposes. The end result is equal to or better than most signal generators in terms of performance. This rather neat idea is a somewhat simplified version of an idea presented by K1CLL in a previous article in *73*.

Once the alignment is completed, the receiver is now capable of pulling in satellite signals, but let's restrain ourselves and finish the final packaging. Obviously everything can be placed in a cabinet of some sort, but I chose to rack mount the assembly in an attempt to reduce the "sprawl" in the satellite station. A standard 19" rack panel 7" in width was used. Drill holes with the proper spacing to accept the layout of the audio gain, squelch, and crystal switch (if used) placement on the minibox, add a cutout and holes for speaker and meter mounting, and proceed with final assembly. The minibox is attached to the panel by the control nuts. Mount the speaker, speaker grill, and the meter and you are almost finished. The receiver can be powered by an outboard 12 volt supply or a supply can be built and mounted to the back of the rack. Fig. 5 shows a suitable power supply circuit. The layout of my own receiver is shown in Fig. 1. Note that the VHF receiver is offset to one side of the panel. This was to provide room for integration of an S band converter for the SMS/GOES satellites – a goodie that will appear in *73* once I am sure it is at the point where it can easily be duplicated. The meter and speaker connections are made plug-in with phono jacks to provide modularization for connection of other gear if desired. The VHF antenna can be connected to the BNC connector and the 12 volt supply – internal or external goes to the +12 V jack. The RECORDER AUDIO jack provides a low level signal to the station tape recorder that is unaffected by the audio gain setting. As noted in the kit instructions, provisions are made for an outboard COR circuit and a discriminator meter that could be added if desired.

Fig. 5. Suggested power supply circuit. D1 – 2 A 50 piv; D2 – 12 V 1 W zener; Q1 – NPN power transistor (30-90 Watts); R1 – 1000 Ohms ½ W; C1 – 1000 mF/35 V; C2 – 1000 mF/16 V; T1 – 25 V 1 A filament transformer; F1 – ½ A fuse; S1 – SPST toggle switch. Q1 should be mounted on an insulated heat sink. Alternatively, a 12 V regulator IC such as the LM-340-12 may be used to replace Q1, R1, D2, and C2. The IC regulator should have its case bolted to the chassis using mounting grease to provide heat sinking.



Performance

In a word, excellent! The receiver, without an outboard preamp, does better than any previous receiver I have tried with or without preamps. Attaching any of my preamps – and I have some pretty good ones – noticeably degrades receiver performance, indicating excellent low noise performance of the basic receiver front end. No receiver tried up to date, even with added preamps, could deliver a full quieting signal from ATS-3 on my 5 element crossed yagi while ATS-1, located close to the horizon at my location, is barely audible on that particular antenna. The new receiver delivers full quieting signals from *both* satellites on the modest antenna without the use of a preamp. Near-horizon fading of the NOAA polar orbiting satellites is eliminated to the point where the receiver limits as soon as the satellites clear the radio horizon. To say that VHF Engineering has done a superb job is certainly not overstating the case. If you want a first-rate satellite receiver, you can hardly go wrong! ■

4 RCA type phono jacks (Switchcraft 3501 FR or equiv.)
1 BNC panel receptacle (Amphenol 4500)
1 7" x 5" x 3" aluminum minibox (BUD CU-3008A or equiv.)
1 1-pole 3-position rotary switch (if multi-channel operation is desired)
1 50 microamp panel meter (Radio Shack)
1 5" speaker (Radio Shack)
1 5" speaker grill (Radio Shack)
1 7" wide rack panel (BUD PA-1104)
2 10k linear taper panel mounting potentiometers (volume and squelch)
2 or 3 knobs, styled to suit. 2 required for volume and squelch, crystal selection optional.
1-3 crystals for frequencies desired. Third overtone, 20 pF load, HC25/U case style:
41.6333 MHz for 135.6 MHz receive
42.2666 MHz for 137.5 MHz receive
42.3066 MHz for 137.62 MHz receive
1 30 kHz 2 pole crystal filter for 10.7 MHz i-f. Model 2196F from Piezo Technology, P.O. Box 7877, Orlando FL ($10.00).
1 12 volt low ripple power supply or components as listed in Fig. 5.
Misc. hookup wire, solder, etc.

Table 1. Components in addition to the basic receiver kit that are required to complete the satellite receiver.

Loran Joly WB0KTH
432 Central Ave.
Mora MN 55051

Learn A New Language !

- - try CW

The familiar term CW rings a bell in every ham's head. Every ham has, at one time or another, learned the Morse code in order to pass a test for his license. But have they actually learned the code, or have they just memorized it?

CW is similar to a foreign language in many ways. For one, it takes countless hours of work to speak fluently in any foreign tongue. Perseverance and motivation are required. Reading and listening will also help in the mastering of a language.

In other words, the "secret" in learning a language is *diligent practice*. There is no other way to escape the practice that is required. I do not want to discourage you from taking up CW as a serious facet of your hamming time. In fact, I am attempting just the opposite. You will make greater gains when you realize the work, time, and energy required.

There are a variety of tapes and records available for the elementary and intermediate CW operator's benefit. These methods work well, and are a good approach to the CW barrier.

Most ham operators send and receive Morse code between the speeds of five and thirty words per minute. At these speeds, the individual letters of each word are deciphered and registered on paper or in our minds. This method is quite acceptable, provided you wish to converse with people at these speeds.

There is, however, a hidden barrier that crops up when you reach approximately thirty words per minute. At and above this speed, you must begin to develop a vocabulary of words. Just as you learned to recognize a letter by its total "phrase," you will have to learn to recognize words by their total "phrases," not by piecing together letters. As the CW is being sent, you should hear words, not individual letters.

How does one acquire this skill? You can practice by tuning in various CW practice stations that operate on a regularly scheduled basis. Schedules of these stations are available from the ARRL. It also helps to have someone send you the more frequently used words and prefixes.

Out of necessity, a person receiving high speed CW will need to learn the art of "copying behind." To practice, just write everything a few words behind what is being sent. By doing this, fewer problems will occur with spelling and capital letters; there will be an overall improvement in the transcription from the mind to the paper.

No matter how fast you may be able to decipher CW in your head, you must be able to transfer it down onto paper if you wish to prove that you have a high proficiency in the translation of CW. There are various organizations which issue certificates for skills in CW proficiency. The Connecticut Wireless Association gives an award to those able to receive and *put onto paper* a 60 words per minute code proficiency transmission. To transfer code at speeds of over 30 words per minute onto paper, a typewriter is needed. Wear headphones as you are typing, so the typewriter will not drown out the CW!

Sending

Most hams cannot send good quality CW above 20 words per minute with a straight key. Therefore, a high percentage of the hams operating CW today use an electronic keyer. Many features are available on a keyer, such as dot and dash insertion, iambic operation, and automatic character spacing. If you desire the most highly advanced and versatile keyer available, then the Accu-Keyer with memory should fill the bill. The 1976 *ARRL Handbook* gives details on how to build this gem. Designed and built by WB4VVF, it has every feature in a keyer a ham could ever want!

If you enjoy typing, you may wish to build or buy a CW typewriter. As you type, CW appears (electrical form!) at the output of this machine. This is an easy method of sending very accurate CW.

As you begin to increase your CW proficiency, you will begin to enjoy this fascinating facet of ham radio more and more. I would be especially interested in hearing from anyone who is able to receive CW at a speed in excess of 60 words per minute. This *is* possible; it just takes practice, practice, practice. ■

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1 High Sensitivity VHF pre-scaler (built-in). 100mv RMS @ 50Ω @ 300MHZ. Frequency range DC through 600MHZ Model 600.

2 Excellent temperature compensation crystal controlled time base, yielding ±1 part/ 10^6 stability per hour after 10 min warm-up, ± 10PPM worst case, from 0^o to + 55^oC!, at 100Hz @ 450MHZ is attainable, typically if calibrated to WWVL. This is approximately 2 parts in 10^7!

3 7 digit display, resolution 100Hz with 10m Sec. gate interval, pre-scaled! 10Hz resolution with 1 Sec. pre-scaled, 1Hz resolution with 10 Sec. gate interval pre-scaled!

4 Built-in 5VDC regulator; input to 3-terminal regulator is accessible for use with 12VDC out-board PS. **You can use this counter mobile.**

5 Easy 6 hour assembly; all circuit broad tracks are pre-tinned, have drilled holes and are plated through! All I.C. sockets included - Makes trouble shooting a breeze.

6 Cabinet, plexy window and all necessary components included for easy, trouble-free assembly.

7 90-Day full coverage warranty.

Optional accessories TCXO time base yielding ½ PPM stability. $79.95

Optional 10 Sec. time gate resolution to 1Hz. $15.00. (Free with purchase of above TCXO)

Optional 12VDC power recepticle and cord assembly $15.00 (on preassembled counter only)

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See You At The Atlanta Ham Festival June 18&19

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C25

A display of early amateur radio memorabilia now at the Pioneer Village Museum in Minden NE.

Amateur radio conventions and regional get-togethers back in the beginning 1920s were real festivities. The spirit which prevailed did so imbue all who attended that a broad new enthusiasm was born and dominated throughout amateur radio land in America.

Reference was made in our last installment to the 1920 grand finale convention in St. Louis. To prove that all the big-wigs, as well as hundreds of the hoi-polloi, were present, here is reproduced that convention's "Programme of Events."

Should any reader who was present have any recollections or recognize any of the "stalwarts" mentioned, I most assuredly would be willing to swap a few yarns.

It would be to the everlasting glory of the proverbial

The History of Ham Radio

- - part III

Eric G. Shalkhauser W9CI
527 Spring Creek Road
Washington IL 61571

Midwest A. R. R. L. Convention

DECEMBER, 28, 29, 30, 1920

St. Louis, Mo.

PROGRAMME OF EVENTS

TUESDAY DEC. 28th.

REGISTRATION

Every one attending the Convention get your INDENTIFICATION BADGES in the lobby of the Hotel Statler These Badges will admit you to all events listed. The Hotel Statler will be the headquarters of the Convention

11:30 a. m. GET TOGETHER GATHERING. 17th floor Hotel Statler. Everybody come to this and meet your old friends and we'll all go down to the Statler Cafeteria for lunch. Statler Cafeteria is down in the basement.

2:00 p. m. RADIO CONTESTS 17th floor Hotel Statler.

The man who designs the CHEAPEST PRACTICAL C W SENDING SET will receive a Benwood Gap. The man who designs the BEST RECEIVING SET will receive ½ k. w. Acme Transformer. These contests will be limited to one hour each.

5:00 p. m. BUSINESS MEETING.

The old bugaboo of Q. R. M. will be discussed and several changes of importance are expected to be made in Methods of Handling Traffic. The main topic under discussion how ever will be, Bill 4868 which is designed to put the Amateur out of Business.

WEDNESDAY DEC. 29th.

10:00 a. m. RADIO COPY CONTESTS

The man who makes the best copy of three mag's sent at a speed of eighteen words a minute will receive Honey Comb Coil Mounting. The man who can receive one mgs. at the highest rate of speed will receive one Audion Amplifier Panel

1:30 p. m. VISIT to STATIONS of ST. LOUIS AMATEURS

Automobiles will be at the entrance of the Hotel to accomodate the out of town men. A route which will take in all the well known Dx stations in St. Louis has been mapped out.

8:00 p. m. TECHNICAL MEETING. 17th. floor Hotel Statler.

SPEAKERS

The "PARAGON" ..... Paul R. Godley
..... Mr. R. S. Glasgow
"GAPS" ..... Mr. H. West
..... R. H. G. Mathews

THURSDAY DEC. 30th

9:30 a. m. DIRECTORS MEETING 17th. floor Hotel Statler

2:00 p. m. THEATRE PARTY ORPHEUM THEATRE 9th & St. Charles Sts.

Arrangements have been made for a large block of good seats. All meet in the lobby of Theatre at 2:00 p. m.

7:30 p. m. RADIO BANQUET 17th. floor Hotel Statler.

SPEAKERS

Mr. Cuntler Mr. Forshay

Prizes donated by the Lyon Star Co., Benwood Co Inc., Marhamm Elect. Co.

Reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA.

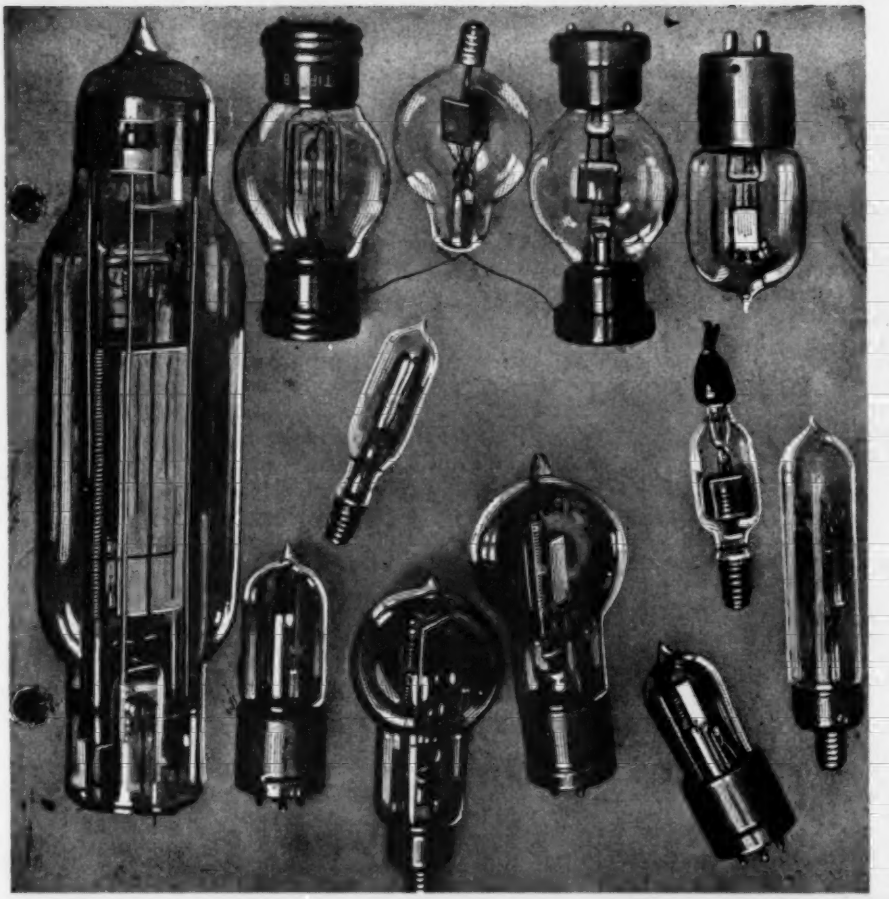
Old Man should any of the sparks of recording effort be transplanted into the pages of amateur history in the future. Probably nothing would surpass the account written in *QST*, February, 1921, pages 9 to 23.

For now, my notebook contains the following account of The American Radio Relay League Convention, as originally written and recorded in January, 1921:

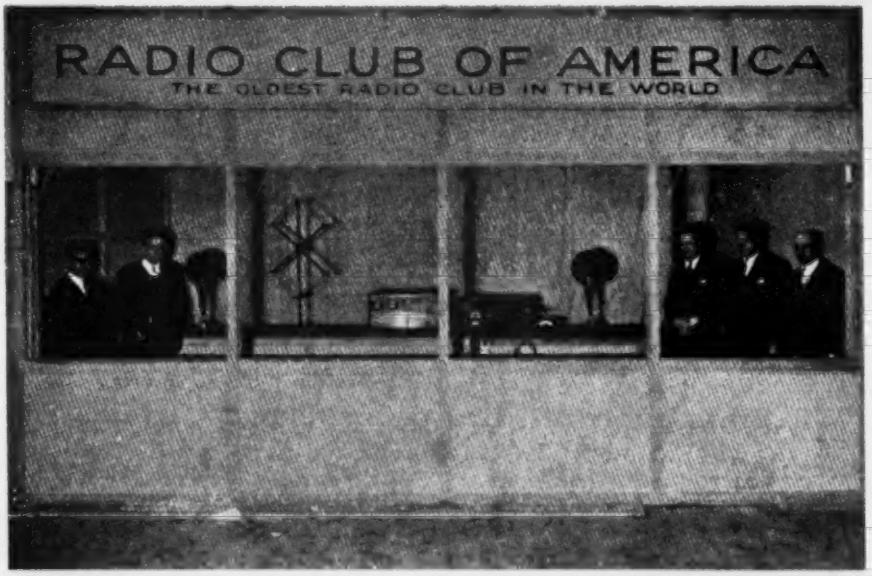
"The Midwest Division of the American Radio Relay League held its convention in St. Louis MO, December 28, 29, and 30, 1920. Representatives from all sections of the country were there, including all of the nine radio districts in the country. Never before in the history of the League has such a successful meeting in the interest of radio taken place. For three days, old and young met, in most cases for the first time, although they had known each other for years.

"Hiram Percy Maxim, well-known scientist and inventor, and President of the League, opened the convention with an address. Mr. Stewart, our representative in Washington, outlined the legislative situation, pointing out how the Poindexter Bill recently introduced in Congress is threatening the existence of amateur radio operators and experimenters. A committee was appointed to draw up definite resolutions to be sent to Washington protesting against the passage of the bill. Mr. Warner, Secretary and Editor of *QST*, gave a resume of our growth from its inception only a few years prior to the war up to the present time. He stated that membership of over 50,000 has placed the organization in a position where it ranks as one of the largest in the country.

"The technical meeting was held on the 29th. Among the speakers were Mr. B. West 8AEZ, naval radio aide and authority on spark dischargers; Mr. Paul R. Godley, chief designing engineer for



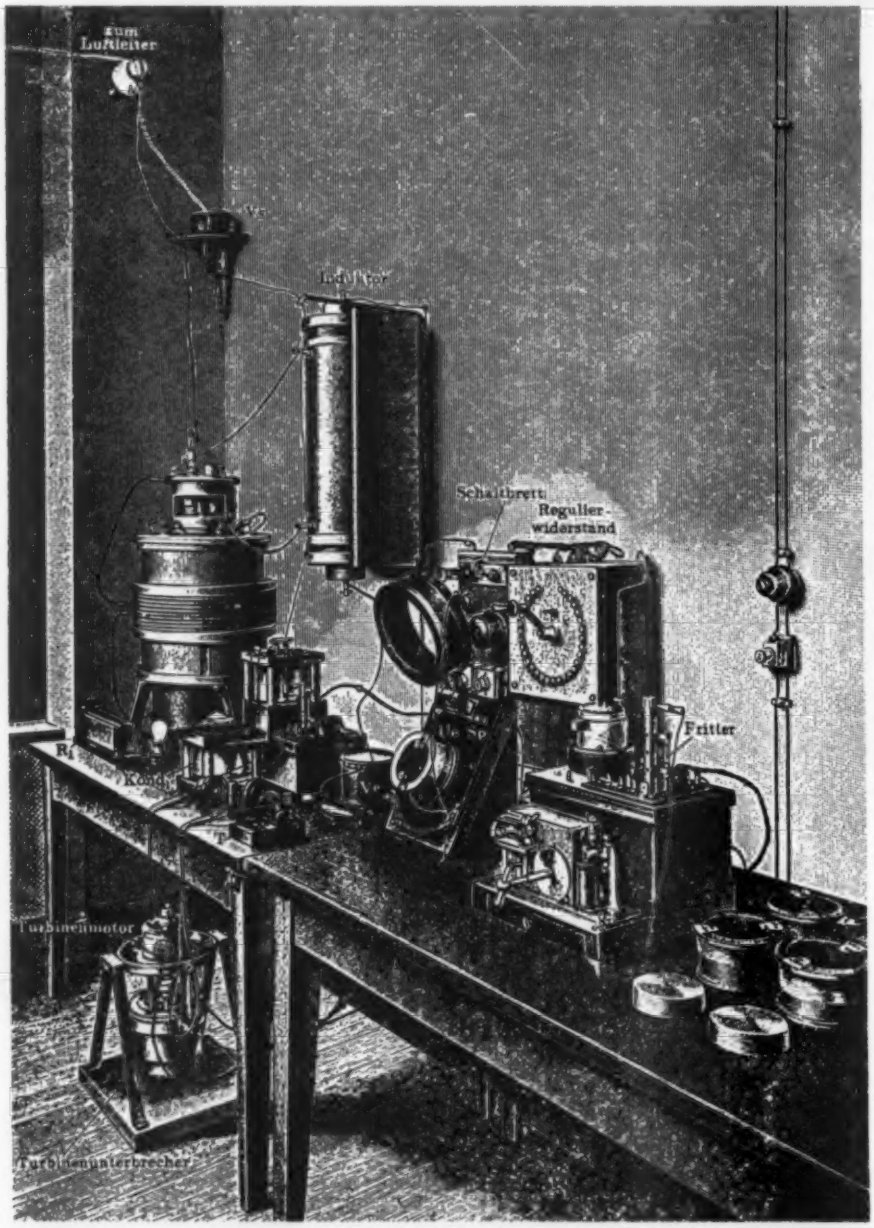
A selection of early vacuum tubes — a far cry from the ultra-miniature transistors and ICs of today.



Public relations were as important in the early days of amateur radio as they are today. In 1922, a group from the Radio Club of America set up and manned this booth at a radio show in Grand Central Palace in New York City.

the Radio Corporation of America; and Mr. R. H. G. Mathews, ninth district superintendent of the League. Topics discussed were in connection with apparatus used in amateur radio stations. Since all amateur stations in the country are restricted by law to operate on a wavelength not exceeding two hundred meters and an input not exceeding one kilowatt, it is essential that all energy put into a set be used to best advantage. The maximum efficiency can be obtained only when apparatus is designed accuately and with special attention to details. The realm of radio is still wide open to improvements with new discoveries continually being made.

"Perhaps of greatest interest was the short but spellbinding address given by Mr. Haddaway, a young man seventeen years old. This lad came from a poor family. As a high school freshman, he had to use his spare time to support the family. He gave us a description of how he made the 'moonshine bulb.' Despite various handicaps, he had built a complete and effective amateur radio station, located in a tiny closet in back of his mother's kitchen. How did he go about accomplishing an 'impossible feat'? Every piece of equipment, including the individual components, were meticulously fabricated out of anything and everything imaginable. Even the headphones and tiny vacuum tubes were homemade. He had located a wholesale drug firm discarding waste material and there found scraps of glass tubing, and bits of tungsten filaments from old lamps. With such parts, he made his vacuum tubes. He had built his own mercury pump to evacuate the tubes. He found the mercury from broken thermometers. His headphones were ingeniously fabricated from bits of wood, metal, and wire, but they performed beautifully. Everything else in his station, which was visited during the day, was very cleverly made and assembled. And his only financial expenditure was a 25 cent pair of combination pliers. I have met no one in my lifetime who has displayed such a passionate purpose to succeed.



The "ideal" amateur station in 1920, consisting of one transmitter and two receivers. One receiver uses an electrolytic detector and telephone set. The transmitter utilizes a mercury interrupter and an open core transformer.

"The climax of the convention was the radio banquet. To our knowledge, it was the first of its kind ever given in the history of the League. The spirit was there all right! What the St. Louis radio club did not think of was not worth considering. Even the menu savored of sparks and ozone, none of it, however, being charged to very high voltage. Mr. Chandler of 8NG fame, Mr. B. West, and the President, H. P. Maxim, gave short addresses. Bill Wood of St. Louis club acted as toastmaster. To him as well as to the entire club is due the credit for the overwhelming success of the convention.

"The keynote of the meetings seemed to be *More Unity and More Cooperation* between the various clubs and organization as a whole, in

order to be able to stand behind any move which the League attempts to undertake. Every city in the country should have an organized radio club affiliated with the League.

"The ARRL was organized with the intention of relaying messages from city to city, state to state, and ultimately from country to country. Messages accepted for transmission are not charged for. Amateur radio operators do this as a service for the community and for mutual benefit because they have an interest in the development of radio as a ready means of communication. The stations are privately owned and operated, in many cases entailing an expenditure of hundreds of dollars. To be able to communicate with others hundreds of miles away amply compensates the amateur for erecting a station. It affords one of the most fascinating and at the same time educational fields of research to most any person interested in science.

"Radio is indispensable in many of our present day developments. Steamships and airplanes are lost if they have to do without the services of wireless. On railroad trains and automobiles, its application will eventually revolutionize modern business practices, just as the telegraph and the telephone have done. But to attempt to make far-reaching predictions, not even the most farsighted radio engineer can come anywhere within the actual facts which will be known ten years from now. (Remember that this was written in 1921.) Too little is understood of this greatest of all discoveries. That we will be able to talk directly with our friend riding in his car in another part of the country seems to be a dream still to be realized." (End of 1921 written and recorded message.)

To be continued.

George Hovorka WA1PDY
John Hovorka, Jr.
674 Brush Hill Road
Milton MA 02186

The Oily Resistor Wattmeter

-- how to put 20 W into a 1 W resistor

Often after an FM rig becomes a few years old, it is desirable to retweak the final output stage. But if you don't have a dummy load and an inline wattmeter, this job can be a problem. Here is a simple device to tune up your two meter transceiver for maximum power output. It is both a dummy load and an rf indicator, and can be built for less than a dollar. It can be used for FM rigs up and into the 20 Watt output class.

The usual problem with constructing a dummy load is finding a resistor which will handle enough Watts and also remain relatively nonreactive at 146 MHz. In our design, this problem is solved by using a 50 Ohm, one Watt composition resistor, and immersing it in a small jar of oil. We can run 18 Watts into this setup for a few minutes without the oil even getting warm. I have used this method successfully to tune up my Regency HR2B and my TR-22. The diode and the capacitor serve as an rf indicator.

This device is constructed by wiring the diode, capacitor, and resistor together as shown in the wiring diagram. Then this assembly is wired to the leads of a piece of RG-58 coaxial cable. Run a separate piece of hookup wire out from the diode and then punch a hole in the top of a baby food jar. Slip the assembly through, and seal the hole with epoxy. Then fill the jar with a high viscosity motor oil, such as SAE 30 or 40. Close the jar top tightly. Then connect a PL-259 connector to the end of the piece of coaxial cable.

To use your dummy load-rf indicator, connect the PL-259 to the back of the radio. Put your VOM on the plus 10 volt dc scale, and connect the positive lead of the VOM to the wire which runs out from the diode. Connect the negative line from the VOM to the braid of the coaxial cable or to the chassis of the radio. Place the transmitter on a frequency which falls in the middle of the frequencies which are used (146.52 MHz). Tweak the capacitors in the final output stage and driver stages with a plastic alignment tool, until you have the maximum indication on the VOM.

With this setup, you can peak your transmitter for maximum output both simply and inexpensively. ■

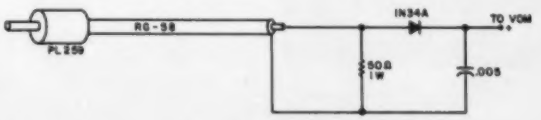


Fig. 1. Wiring diagram.

Parts List

PL-259 connector
18" length of RG-58 coaxial cable
1 W 50 Ohm composition resistor
1N34A or equivalent germanium small signal diode
.005 disc ceramic capacitor
Hookup wire
Baby food jar
SAE 30 motor oil
VOM
Epoxy

SSTV Slalom Game

-- you don't need a sports car

Dave Ingram K4TWJ
Eastwood Village #604 No.
Rt. 11 Box 499
Birmingham AL 35210

If you've ever been interested in TV ping pong, hockey, space war, or any other popular TV game, then here's an SSTV game I'm sure you'll like. The game features moving action, programmable courses, black or white displays, optional scoring, and much more. The basic unit costs approximately five dollars to build and the optional scoring section costs an additional five dollars.

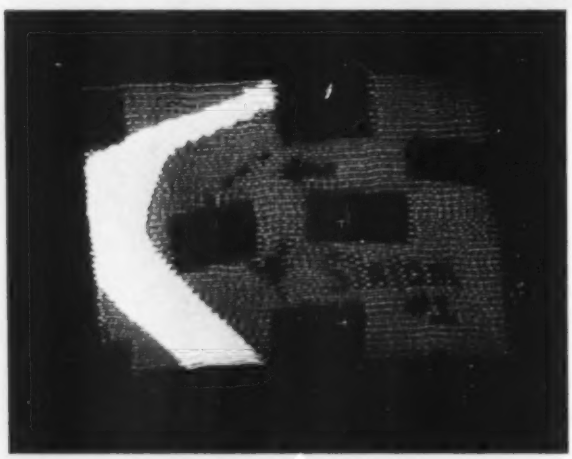
This game is a video representation of the popular sports car autocross, or slalom, races which are conducted by sports car clubs around the world. Contesting autos in a slalom individually maneuver through an obstacle course which is marked by rubber pylons. Tricky courses are commonplace, so driving skills and accuracy are the primary considerations. If you've never experienced an actual sports car slalom, you've missed a treat. Full details on local slaloms can usually be obtained from MG or Triumph dealers in your area. *SSTV Slalom* consists of an obstacle course, displayed on the monitor screen, and a "car" (thin line) which moves down the screen along with the initial trace. A pot is used for steering the line around pylons (black squares), and a simple 1, 2, 4, 8 counter performs optional scoring.

The challenge of slalom driving is captured in the game's positive response to steering commands, and in courses which can be made increasingly difficult as you become more skillful. During a typical "run," the car might be steered left and driven through a pylon. As it's steered back on course, it continues to move down screen, and is again meeting a turn and dodging pylons. A run is completed at the screen's bottom right, and bam! The car restarts at the screen's top left, again dodging pylons to get on course. Each run lasts approximately 8 seconds — the length of an SSTV frame.

Description

SSTV Slalom can be divided into three categories: the course, the car, and the optional accessories.

As this is intended to be a fun project rather than a soldering experience, I chose to utilize one's existing SSTV camera (or tape recorded SSTV) to generate all the necessary timing signals and to permit frequent course changes. This approach (known by computer freaks as letting software make up for a deficiency in hardware) proved to be more flexible and substantially less expensive then other methods of generating TV games. Each slalom course is drawn on a separate piece of paper and sequentially placed in front of the SSTV camera. A forty or fifty Watt lamp will provide sufficient illumination if the courses are placed on small index cards. An alternate method is to draw the courses on photographic slide blanks, then place these in an inexpensive slide viewer and



Six second exposure of a Slalom run. Although not apparent in this photo, the complete course was visible on the monitor screen.

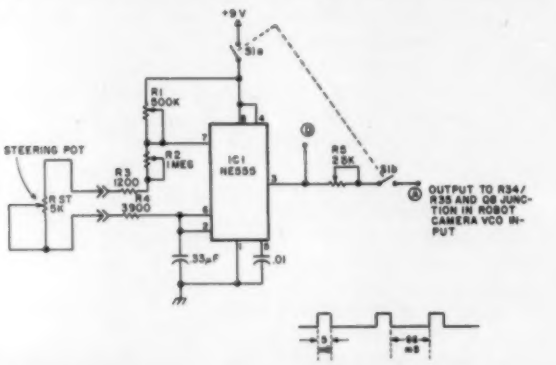
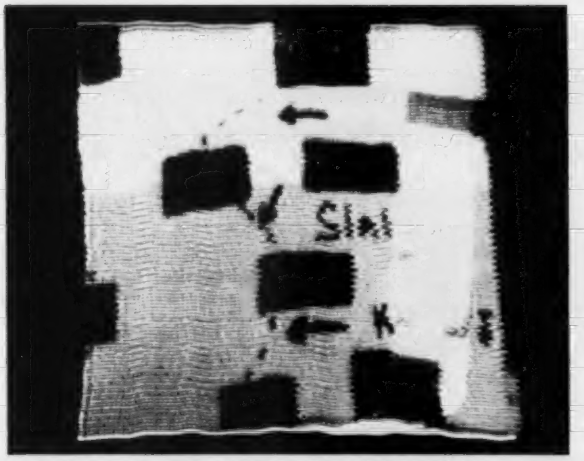


Fig. 1. Basic car generator. R1 — car frequency; R2 — car width; RSt — car steering; R5 — output amplitude.

This ten second "stop motion" photo of Slalom closely resembles an actual run in progress. During the first 8 seconds, the car was steered down the screen's right side. Then it was quickly steered on course before the camera's shutter closed 2 seconds later. I'll let you guess the run's results.

Capturing Slalom's action on film is quite difficult, as each run tends to erase the previous run and an 8 second frame doesn't portray motion. Proper "f" settings of double exposure photos are also difficult.



Another ten second "stop motion" photo of Slalom.

point the SSTV camera's lens into the viewer. Particular attention should be given to the beginning (screen top) and end (screen bottom) of each course for a smooth overall effect. I suggest trying some initial courses with various size obstacles and paths to get the game's "feel." The only remaining requirement is a car which can be driven through the monitor displayed course.

The car is simply an unsynced black (or white) level generator with its exact frequency controlled by a steering pot (see Fig. 1). Span limiting resistors are used with the steering pot to control car swing and produce a sports car type "feel." (No fair replacing this section with a 10k pot. A bug eyed Sprite or Lotus Elan doesn't even handle that good!) Output of the basic generator connects to an SSTV camera's voltage controlled oscillator input to combine car and course. Since I use a Robot model 80A camera, Fig. 1 gives the proper connection points for that unit. A similar concept can be used with other SSTV cameras. Simply connect the car generator's output (point A) to the camera's VCO input, in parallel with modulation voltages from the video amplifiers. Isolate levels as necessary to prevent overloads or low resistance paths. Direct connection of the car generator to the Robot's VCO will require a slight readjustment of the brightness control. I merely reach over and turn the control approximately ½ turn clockwise. However, lazy hams can include the circuitry of Fig. 2 and eliminate this effort.

One optional feature of *SSTV Slalom* is a car generator to be used in conjunction with cassette taped courses received from other SSTVers. This method also allows camera-less SSTVers to play *SSTV Slalom* on tape recorded courses. The additional 1500 to 2300 Hz oscillator circuitry for this feature is shown in Fig. 3. Another 555 IC is used as a 1500 Hz (black car) or 2300 Hz (white car) oscillator. Pulses from the basic car generator (point A of Fig. 1) key this oscillator at a 15 Hz rate. Output tones from the oscillator are directly mixed with SSTV from a tape recorder, and applied to the monitor input. A small amount of interference has been noticed while using this setup. However, it can be eliminated by using bandpass filters. I didn't include a filter because the *Slalom* pictures were merely being viewed rather than being transmitted.

Although *Slalom* in its most basic form provides all the fun of full blown TV games, optional scoring may provide an added bonus. This is accomplished by including the circuitry shown in Fig. 4. Two 7476s are wired as a simple 1, 2, 4, 8 counter and a 7400 is used to AND camera and car generator levels. When the camera produces a black level pulse (indicating a pylon), *and* the car generator produces a black level pulse (indicating the car), a binary 1 pulse is applied to the 7476 counter. Some isolation/processing of input levels is desirable, thus sections A, B, and D of the 7400 are wired as inverters. Light emitting diodes are connected between "Q" and ground of each J-K flip-flop to indicate score. These diodes will indicate counts from 0 to 15 (1111, or all four LEDs lit) before resetting, or S1 can be used to reset the counter after each run. This gives the SSTVer two options: He can score each run separately, or let the counter accumulate several runs and divide its total by the number of runs to derive an average score.

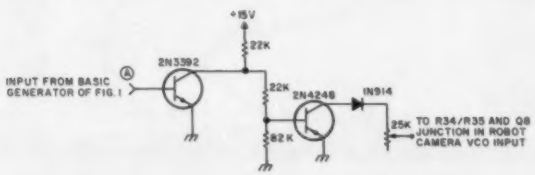


Fig. 2. Optional car/Robot interface.

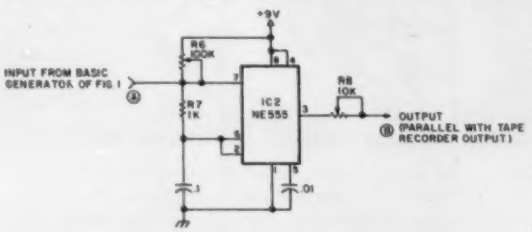


Fig. 3. Optional 1500/2300 Hz oscillator.

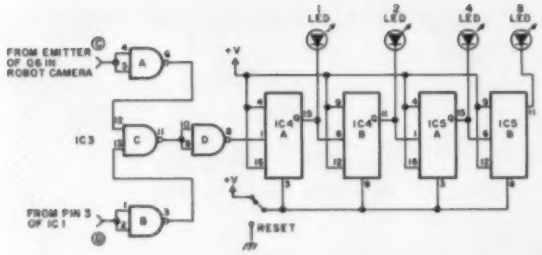


Fig. 4. Optional scoring for Slalom. IC3 – 7400, +V = +5 V. IC4 and IC5 – 7476.

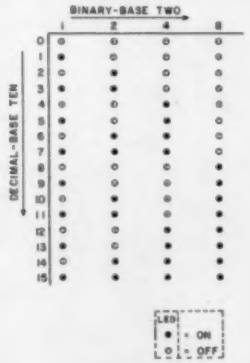
Construction

Because the highest frequency associated with *Slalom* is 2300 Hz, vectorboarding components is quite sufficient. Resistor values shown permit ample variations of frequencies and amplitudes, so there should be no problem getting a properly wired unit working. IC sockets are suggested if surplus 555s are used which may work incorrectly.

The actual game can be built several different ways to suit particular interests, so feel free to "tailor" your design.

I built two versions of *Slalom* and they both worked smoothly after initial alignment. One version consists of a basic "car" generator (Fig. 1) and scoring counter (Fig. 4) mounted on a 3 by 5 inch board. The board is mounted vertically in my Robot camera. Connections for on/off, steering, and paralleling VCO input are output to a small minibox via a Cinch Jones jack mounted on the camera's rear. An eight foot cable permits the minibox to be moved as desired. Of course, the basic unit can be mounted in a cabinet and its output connected to the camera's VCO via a small jack on the camera's rear, if desired. My other version of *Slalom* is a portable unit which uses the circuitry shown in Fig. 1 and Fig. 3. This unit, and some cassette taped courses, allow the game to be played anywhere on an ordinary SSTV monitor. This game generator is built on a 2 by 3 inch vectorboard and mounted in a small minibox. An on/off switch, output jack, and steering pot are mounted on the box front. Scoring is not included in this simple unit.

Fig. 5. LED pattern associated with counter of Fig. 4.

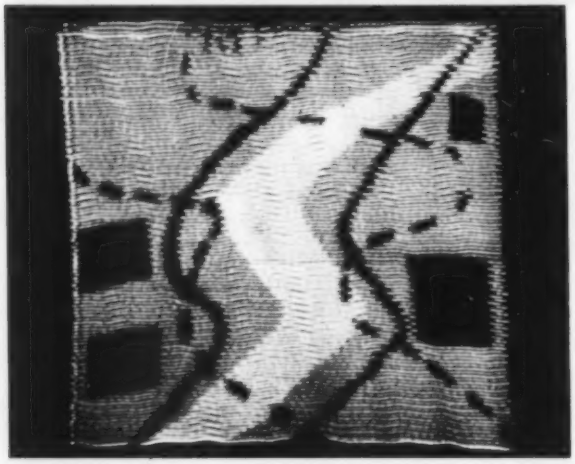


Alignment and Operation

The first step in game alignment requires tuning the car generator for an output of 15 pulses, 5 milliseconds wide, each second. An oscilloscope is helpful in making this adjustment, but it's not mandatory. Clip lead a light emitting diode between pin 3 of IC1 and ground, then adjust R1 until the LED flickers at a slow rate. Next, adjust R2 until the diode's "on" time is considerably less than its "off" time. Now readjust R1 until the LED is flashing almost continuously, and the generator will be very close to calibration. Final "tweaking" can be accomplished while watching the monitor screen.

The basic game is completed by making proper connections to your SSTV camera; place a sketched course in front of the lens and obtain a sharp picture on the monitor. The course should fill the screen precisely, with no overshoot. Switch on the car generator and adjust R5 until a line (the car) is visible on the monitor screen. Don't overadjust R5, or the camera's frequency swing will be excessive. If you have trouble obtaining a line, cap the camera lens and adjust the camera brightness pot. If more than one line is visible, the setting of R1 is too high. If the line is too wide, the setting of R2 is too high. Operations of these controls interact, so stay cool and make adjustments very slowly. A properly adjusted unit will produce one thin line which can be swung to either side of the screen as it moves downward with the initial trace. Uncapping the camera lens should result in both course and car being displayed on the monitor. If everything is properly adjusted, you should be able to maneuver the car through the displayed course.

Alignment of the self-contained version of *Slalom* (Fig. 1 connected to Fig. 3) consists of setting the basic car generator using the pre-

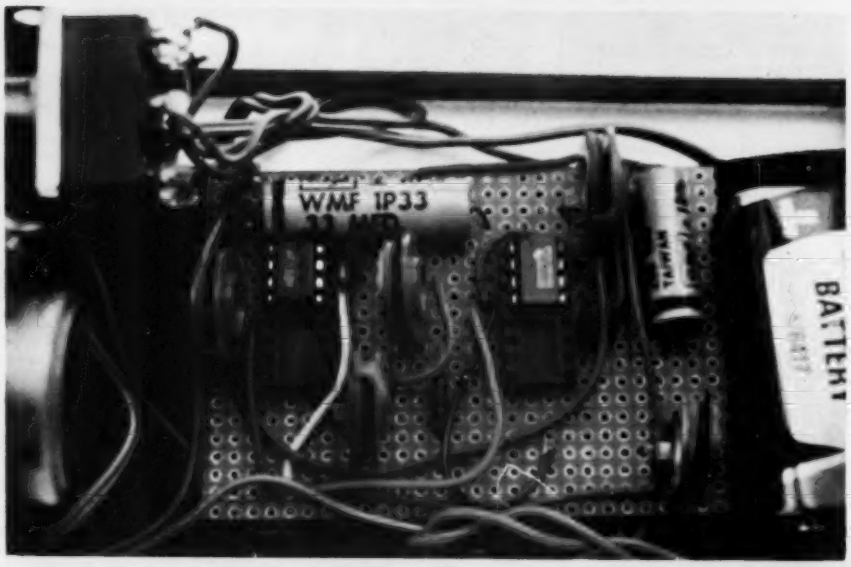


This course features two tracks. Runs are alternated between the solid-lined track and the dotted-lined track. When the car finishes at the left bottom and reappears at the left top, it's turning left and must make a sharp right turn. This course keeps you hopping.

A Slalom course as displayed on the monitor screen, with the car generator switched off.

viously described LED technique, then adjusting R6 until IC2 operates at 1500 Hz (black car) or 2300 Hz (white car). IC2 should be adjusted with IC1 unplugged and a small speaker or frequency counter connected between point B and ground. Now reinsert IC1 and adjust R5 until clean, sharp pulsed tones are acquired at point B.

Operation of the scoring counter can be checked by applying ≈ 4.5 volts to point C, then pulsing point D with the same ≈ 4.5 volts. Each pulse should increment the counter one time, as illustrated in Fig. 5. Removing ≈ 4.5 volts from point C should disable the counter when point D is pulsed.



Portable Slalom generator consisting of the circuitry in Fig. 1 and Fig. 3. 15 Hz oscillator is toward front (pot and switch), and 2300 Hz oscillator is near rear (battery). A felt pad insulates board wiring from minibox.

Conclusion

Slalom is an inexpensive SSTV game that SSTVers can enjoy singularly, or in groups. Courses can be designed on paper and exchanged over the air or via mail. Video inversion of courses produces some very striking displays of *Slalom*, and 4 second frames can accelerate game action. I think that you too will enjoy building and playing this simple game.

The idea of *Slalom* hit me during a recent siege of poor band conditions. Continual fruitless calling (at the kW level, no less!) finally convinced me to "do my own thing." Sure enough, it worked. Every time I switched on *Slalom*, the band opened. ■

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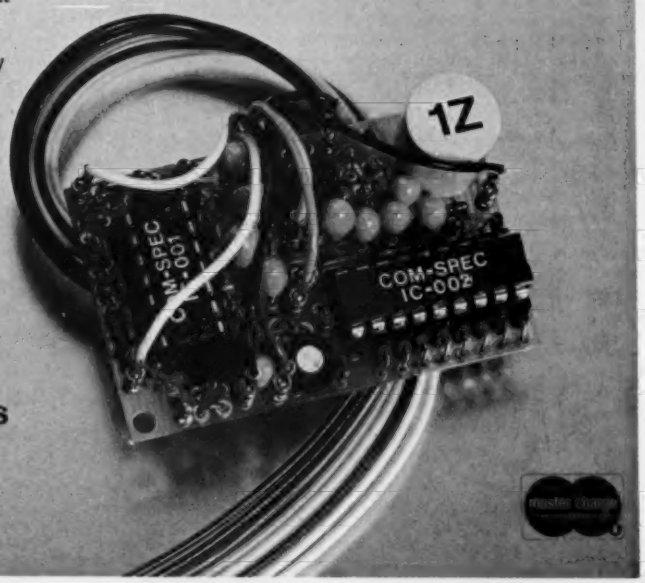

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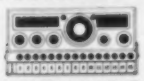

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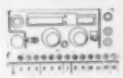

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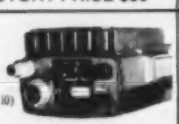

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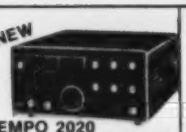

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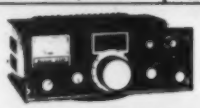

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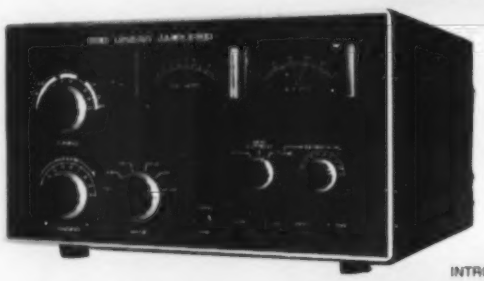

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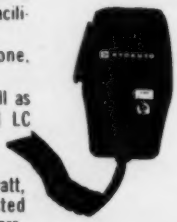

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Browsing through the vast *treasure trove* of articles, labeled as back issues of *73 Magazine* in our high school library, a very good article caught my eye. Entitled "How You Can Take Oscar's Temperature," this particular article described OSCAR 7's telemetry information, including formulas to decode the telemetry. After thinking for a bit, a little bug (actually a PROM memory keyer, I think) flew into my ear and said, "Heck, Herro, you could write a computer program for that!" I said, "You're right!" So I did. Thus, this article was born.

A Little Background

For the few (very few, especially if you read this magazine) who may not know, both OSCAR 6 and OSCAR 7 are alive, well, and

Fig. 2. Program listing.

```
LIST
OSCAR7     03:06 PM          11-FEB-77
10 PRINT"OSCAR-7 TELEMETRY DECODING PROGRAM"
20 REM BY MARK HERRO, WB9LSS
30 INPUT"TYPE DATE (GMT) OF COPY (DAY, MONTH, YEAR)";D,M,Y
40 INPUT"ORBIT #";O
50 DIM A(24)
60 REM 'A' CAN NOW HAVE 24 INPUTS
70 REM GET READY FOR INPUTS
80 PRINT"TYPE ONE NUMBER PER '?', DELETING THE FIRST NUMBER"
90 PRINT"OF THE THREE NUMBER SET (I. E. USE 23, 43, 77, 80. . ."
100 PRINT"INSTEAD OF 123, 143, 177, 180,. . .)"
110 FOR Y=1 TO 24
120 INPUT A(Y)
130 NEXT Y
140 REM ****DECODING MEAT****
150 PRINT"TOTAL SOLAR ARRAY CURRENT (MA)="
160 PRINT 29.5 * A(1)
170 PRINT"+X QUADRANT CURRENT (MA)="
180 REM LET N=A(2) THEN GOSUB TO RIGHT EQUATION
190 LET N=A(2)
200 GOSUB 9000
210 PRINT"-X QUAD. CURRENT (MA)="
220 LET N=A(3)
230 GOSUB 9000
240 PRINT"+Y QUAD. CURRENT (MA)="
250 LET N=A(4)
260 GOSUB 9000
270 PRINT"-Y QUAD. CURRENT (MA)="
280 LET N=A(5)
290 GOSUB 9000
300 REM SO MUCH FOR THE REPEATS FOR GOSUB 9000
310 PRINT"70/2 OUTPUT POWER (WATTS)="
320 REM IF INPUT IS '00' ODDS ARE 70/2 IS SHUT DOWN
330 PRINT 8*(1-.01*A(6))↑2
340 PRINT "SHIP TIME (HOURS)="
350 REM TIME INCREASES 1 INCREMENT EVERY 14 MINUTES
360 PRINT .253*A(7)
370 PRINT"BATTERY CHARGE/DISCHARGE CURRENT (MA)="
380 PRINT 40*(A(8)-50)
390 PRINT"BATT. VOLTAGE (VOLTS)="
400 PRINT .1*A(9)+6.4
410 REM I DONT KNOW WHY THEY PUT THIS NEXT ONE IN, BUT. . .
```

```
420 PRINT"ONE HALF BATT. VOLTAGE (VOLTS)="
430 PRINT .1*A(10)
440 PRINT"BATT. CHARGE REGULATOR #1 (VOLTS)="
450 PRINT .15*A(11)
460 PRINT"BATT. TEMPERATURE (CELCIUS)="
470 REM START SECOND SET OF REPEATED NUMBERS (9500)
480 LETN=A(12)
490 GOSUB 9500
500 PRINT"BASE PLATE TEMP. (CEL)="
510 LET N=A(13)
520 GOSUB 9500
530 PRINT"P.A. TEMP. 2/10 TRANSPONDER (CEL.)="
540 LET N=A(14)
550 GOSUB 9500
560 PRINT"+X FACET TEMP. (CEL.)="
570 LET N=A(15)
580 GOSUB 9500
590 PRINT"+Z FACET TEMP. (CEL.)="
600 LET N=A(16)
610 GOSUB 9500
620 PRINT"P.A. TEMP. 70/2 TRANSPONDER (CEL.)="
630 LET N=A(17)
640 GOSUB 9500
650 PRINT"P.A. EMITTER CURRENT 2/10 (MA)="
660 PRINT 11.67*A(18)
670 PRINT"TRANSPONDER MODULATOR TEMP. 70/2 (CEL.)="
680 LET N=A(19)
690 GOSUB 9500
700 REM END OF ALL THE REPEATED EQUATIONS
710 PRINT"INSTRUMENT SWITCHING REGULATOR CURRENT (MA)="
720 PRINT 11+.82*A(20)
730 PRINT"2/10 TRANSPONDER POWER OUT (MW)="
740 PRINT A(21)↑2/1.56
750 PRINT"435 MHZ BEACON POWER OUT (MW)="
760 PRINT .1*(A(22)↑2)+35
770 PRINT "2304 MHZ BEACON POWER OUT (MW)="
780 PRINT .041*(A(23)↑2)
790 PRINT"MIDRANGE TELEMETRY CALIBRATION (VOLTS)="
800 PRINT .01*A(24)
810 REM GOSUB EQUATIONS
820 GOTO 9700
9000 PRINT 1970-20*N
9100 RETURN
9500 PRINT 95.8-1.48*N
9600 RETURN
9700 END
```

broadcasting their onboard Morse code telemetry, transmitting the ship's status to anyone who happens to be listening. So although this article describes the OSCAR 7 telemetry decoding, the same technique can be applied to OSCAR 6 (and future OSCARs) as well. OSCAR 7's telemetry during Mode A (2m/10m) is transmitted on 29.502 MHz. Thus, anyone with a low band receiver (which means most hams and SWLs around) is capable of at least listening to the satellite and copying telemetry.

The telemetry itself consists of a cycle (called a *frame*) of twenty-four numbers divided into a pattern of six *lines*, and divided again into four *channels* to each line. Channels are designated A, B, C, and D. Thus, any specific number could be referred to as "channel 5C," or whatever. Fig. 1 illustrates. Each number represents a different function or status of the ship. Coming from OSCAR, the telemetry might read like this: HI HI 114 127 143 195 218 223 262 ... Notice the pattern of 1A, 1B, 1C, 1D, 2A, 2B, 2C, ... The "HI HI" at the beginning merely separates each full frame of numbers — the telemetry transmits continuously.

LINE #	1	2	3	4	5	6
Channel						
A	1—	2—	3—	4—	5—	6—
B	1—	2—	3—	4—	5—	6—
C	1—	2—	3—	4—	5—	6—
D	1—	2—	3—	4—	5—	6—

Fig. 1. Telemetry channels.

The Program

Although the program is written in BASIC for a DEC PDP/11-45 (the only system I have access to — heck of a toy!!), I tried to keep the program straightforward enough to adapt to any of the other forms of BASIC floating around. It shouldn't take that much memory either. See Fig. 2 for listing.

A little explanation of the program seems to be in order. First of all, the "Date of Copy" and "Orbit #" inputs (lines 30 and 40) are for the operator's information and convenience only. I included them to keep the reception and orbital data straight for future reference, especially if the output is to a TTY or other hard copy device.

Another possible confusing feature is the request to delete the first number of each channel (line 80). The first digit in each channel — the line number (i.e., *1*23 ... *2*15 ... *3*67 ... etc.) — is for reference only and is not involved in any calculation! So if you use the program as is, you would type "23, 41, 77 ..." instead of "123, 141, 177 ..." It's possible, of course, to delete that first number within the program, but for the sake of simplicity (and less hassle for the programmer, not to mention memory!), I chose to do it this way. Fig. 3 shows a sample run to illustrate the program operation (I used a "1" as the input in each case).

Since some of the formulas use the same math equation, instead of just retyping that same thing over and over again while putting in the program, I just stuck in the GOSUB statements for lines 9000 and 9500. Let the computer do the work. This is first demonstrated with the "+X Quadrant Current" statement. There are two separate formulas used repeatedly. The answers to *all* the equations will be in the units specified in the preceding PRINT statement. The usual abbreviations apply: milliamp = mA, milliwatt = mW, temperature in Celcius (later in the program, just "Cel"), etc. If you still don't quite understand the program operation, see the flowchart in Fig. 4 for help.

Bells and Whistles

Once you have the bloody thing running, it's kind of fun to see for yourself how OSCAR is doing up there. And, of course, you don't have to stop where the program ends; there are a number of possible modifications. Subtracting out the first number of the channel by the program is one thing, as I said earlier. Or you could try to just calculate one number out

```
READY

RUN
OSCAR7     03:14 PM              11-FEB-77
OSCAR-7 TELEMETRY DECODING PROGRAM
TYPE DATE (GMT) OF COPY (DAY, MONTH, YEAR)? 00,00,00
ORBIT #? 00000
TYPE ONE NUMBER PER '?', DELETING THE FIRST NUMBER
OF THE THREE NUMBER SET (I. E. USE 23, 43, 77, 80. . .
INSTEAD OF 123, 143, 177, 180,. . .)
? 1                          TEST
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
? 1
TOTAL SOLAR ARRAY CURRENT (MA)=
 29.5
```

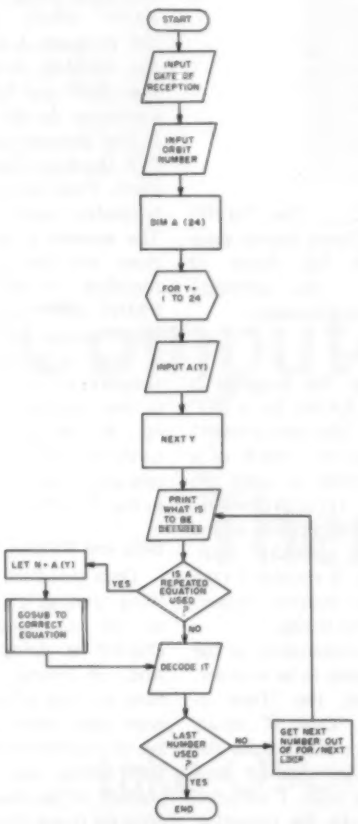

Fig. 4. Program flowchart.

```
+X QUADRANT CURRENT (MA)=
 1950
-X QUAD. CURRENT (MA)=
 1950
+Y QUAD. CURRENT (MA)=
 1950
-Y QUAD. CURRENT (MA)=
 1950
70/2 OUTPUT POWER (WATTS)=
 7.8408
SHIP TIME (HOURS)=
 .253
BATTERY CHARGE/DISCHARGE CURRENT (MA)=
-1960
BATT. VOLTAGE (VOLTS)=
 6.5
ONE HALF BATT. VOLTAGE (VOLTS)=
 .1
BATT. CHARGE REGULATOR #1 (VOLTS)=
 .15
BATT. TEMPERATURE (CELCIUS)=
 94.32
BASE PLATE TEMP. (CEL)=
 94.32
P.A. TEMP. 2/10 TRANSPONDER (CEL.)=
 94.32
+X FACET TEMP. (CEL.)=
 94.32
+Z FACET TEMP. (CEL.)=
 94.32
P.A. TEMP. 70/2 TRANSPONDER (CEL.)=
 94.32
P.A. EMITTER CURRENT 2/10 (MA)=
 11.67
TRANSPONDER MODULATOR TEMP. 70/2 (CEL.)=
 94.32
INSTRUMENT SWITCHING REGULATOR CURRENT (MA)=
 11.82
2/10 TRANSPONDER POWER OUT (MW)=
 .641026
435 MHZ BEACON POWER OUT (MW)=
 35.1
2304 MHZ BEACON POWER OUT (MW)=
 .041
MIDRANGE TELEMETRY CALIBRATION (VOLTS)=
 .01

READY
```

Fig. 3. Program sample run.

of a whole frame. If you really wanted to go all out, you could try getting your system to take the telemetry Morse code off the air (adjusting for the Doppler shift), decode the information, and print it out at the same time!!

Conclusion

With a minimum of time and effort, it wouldn't be hard to "take OSCAR's temperature" the easy way. If you have a hard copy printout, all the better. You might even try taking a long-term survey of the satellite's performance by saving the information you collect for a time, then graphing the data with your new graphics system! Don't forget AMSAT; I'm sure they would be interested, too.

Now, after you have all that set up, try checking into OSCAR 9's telemetry. That'll have 128 channels when it is launched. ■

References

Kasser, "Oscar Facts," *1977 Ham's Almanac*, Number 2, 1977, p. 2.

Kasser and King, "Oscar 7 and its Capabilities," *QST*, February, 1974, p. 56.

"Oscar News," *QST*, February, 1975, p. 63.

Soifer, "Getting Started in Satellite Communications," *AMSAT Newsletter*, Vol. VI, June, 1974 (revised ed., Dec., '74).

Tater, "How You Can Take OSCAR's Temperature," *73*, July, 1975, p. 57.

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Computerized RTTY Takeover!

- - Digital Group cassette to TU conversion

A previous article[1] described how to connect a microcomputer to the ST-6 RTTY TU and how to program the computer for RTTY operation. Since all those interested in computer generated TTY may not have an ST-6 TU, I looked into the possibility of using The Digital Group Cassette Interface PC card[2] as a RTTY TU. This article presents the results of those efforts.

The Digital Group Cassette Interface PC card is designed for recording data as well as receiving data previously recorded in a microcomputer system. AFSK is used, with the MARK being 2125 Hz and the SPACE being 2975 Hz. Several circuit modifications were made to the PC board to change it into a low cost RTTY TU. These include shifting the SPACE frequency to 2295 Hz for narrow shift operation and adding two LED tuning indicator circuits to aid tuning in the RTTY signal.

The units as now configured will detect narrow shift RTTY signals, generate narrow shift AFSK signals, provide keyed input for CW ID, and will directly interface with the input/output ports of The Digital Group 8080 microcomputer.

A very detailed circuit description of the cassette interface board is given in the kit assembly instructions and will not be repeated in this article.

Circuit Board Modifications

In order to find space to install the LED drivers, a portion of one of the voltage bus lines was cut and rerouted by adding two jumpers. The cut segment of the line was removed, and holes were drilled in the board to mount the LED driver transistor sockets and resistors as shown in the PC board sketch. External connections from the LED indicators were made to PC board pins 16 and 17. The selected resistors and capacitors required to retune the filters and VCO to the narrow shift frequencies are also noted on the PC board sketch. No other modifications were required to put the PC board into operation.

Construction

The PC board and power supply are mounted in a cabinet 8" wide by 5-3/4" deep by 2" high, a Ten Tec model JW-8. The power transformer selected did not originally have a center tap. The transformer laminations were disassembled and the primary windings were removed and stored temporarily on an empty wire spool. The secondary dc resistance was measured and sufficient turns were unwound until the center tap point (½ the dc resistance of the secondary winding) was reached. The center tap was brought out and the wire rewound on the form. The primary was then rewound on the transformer form, and the part was reassembled with the coil form inverted 180 de-

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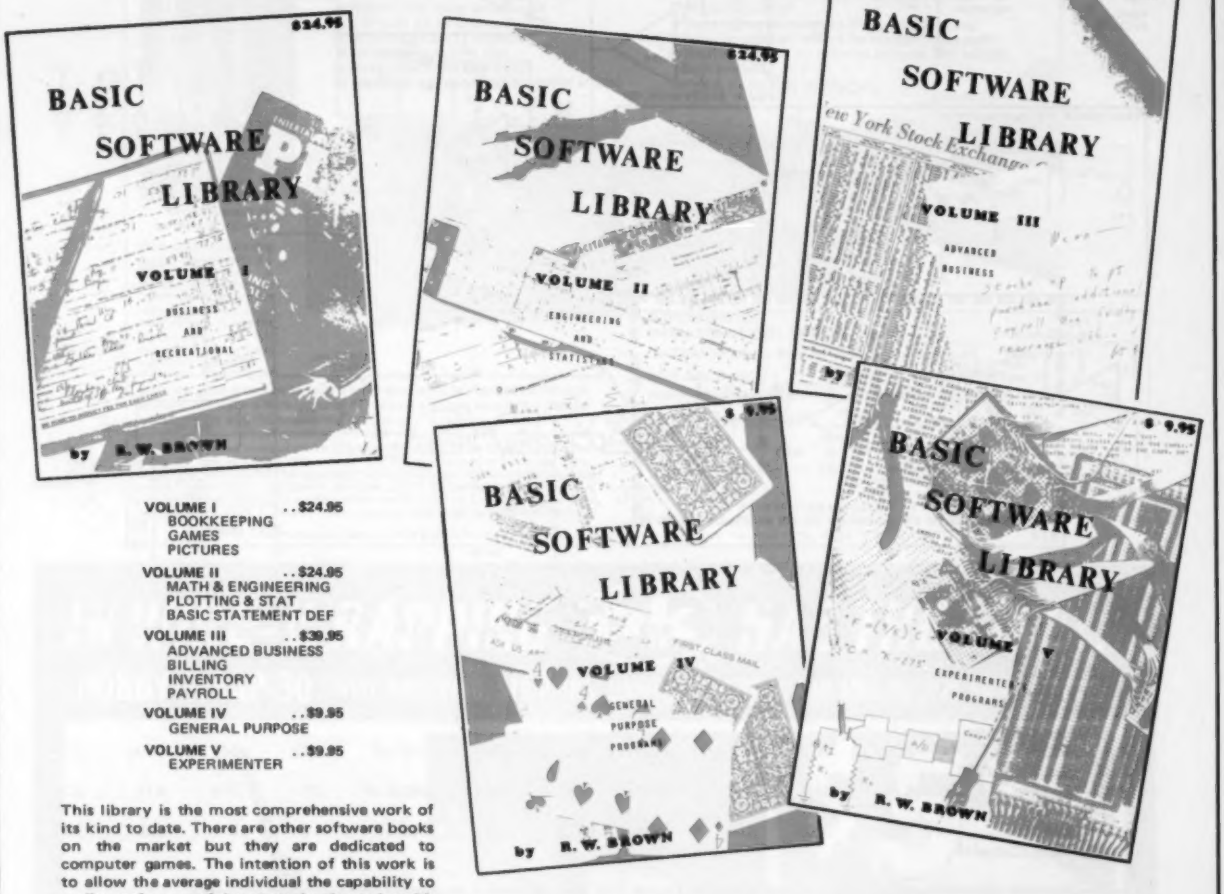

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Each program's source code is listed in full detail. These source code listings are not reduced in size but are shown full size for increased readability. Almost every program is self instructing and prompts the user with all required running data. Immediately following the source code listing for most of the programs is a sample executed run of the program.

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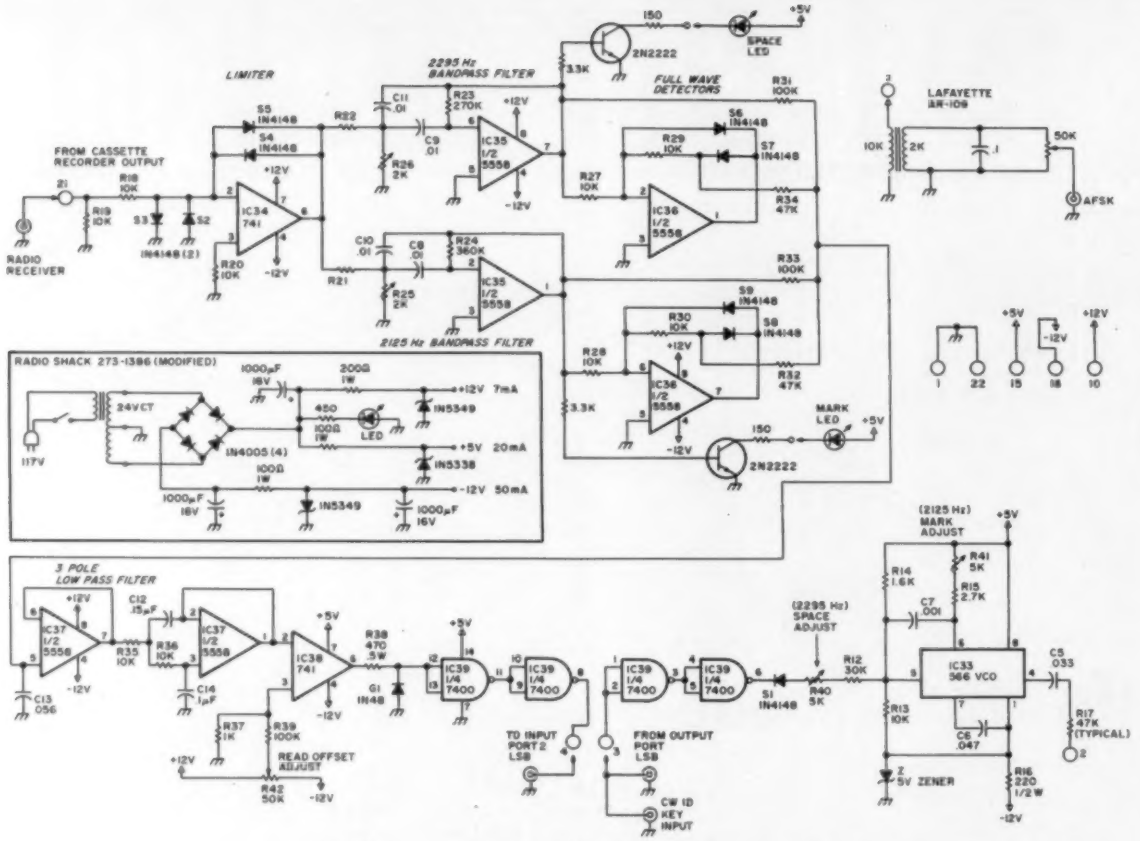


	Low Filter			High Filter			Low Pass Filter			VCO	
	R21	R24	R25*	R22	R23	R26*	C13	C12	C14	R12	R15
2125-2975 Hz 1100 Baud	6.8k	68k	938	4.7k	47k	697	.0056 uF	.01	.015	2.7k	1.3k
1200-2400 Hz 300 Baud (Simple)	6.8k	68k	4173	4.7k	47k	1162	.0056 uF	.01	.015	470k	2.7k
1200-2400 Hz 300 Baud (Correct)	12k	120k	1668	5.6k	56k	906	.015 uF	.033	.047	470k	2.7k
2125-2295 Hz 100 Baud (Simple)	6.8k	68k	938	4.7k	47k	1301	.0056 uF	.01	.015	47k	2.7k
*2125-2295 Hz 100 Baud (Correct)	36k	360k	156	27k	270k	179	.056 uF	.15	.1	30k	2.7k

* means that the value so indicated is the typical calculated value. The precise value is dependent on component tolerance.

Fig. 1. System block diagram.

grees to put the terminal lugs as far away from the mounting feet as possible.

A power ON pilot light indicator was made by monitoring the rectified secondary voltage with an LED protected by a current limiting resistor. The output of the VCO is a triangularly shaped wave, and is not suitable for modulating an SSB HF transmitter. An output transformer was installed in the unit and a .1 capacitor was connected across the secondary of this transformer to modify the wave shape into a sine wave. A gain control was added to aid in adjusting the output to a level suitable for the microphone input of the SSB transmitter. When the unit was first constructed, the output transformer was mounted near the power transformer. This caused hum to appear in the output of the AFSK signal, so it was moved up to the front of the unit and out of the strong ac field of that transformer. This

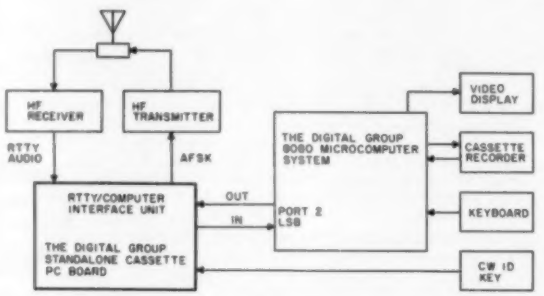
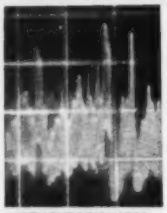
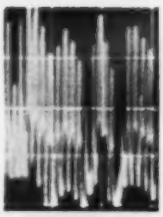


Fig. 2. Schematic diagram of modified Digital Group cassette interface circuit.



WITHOUT DOMINATOR



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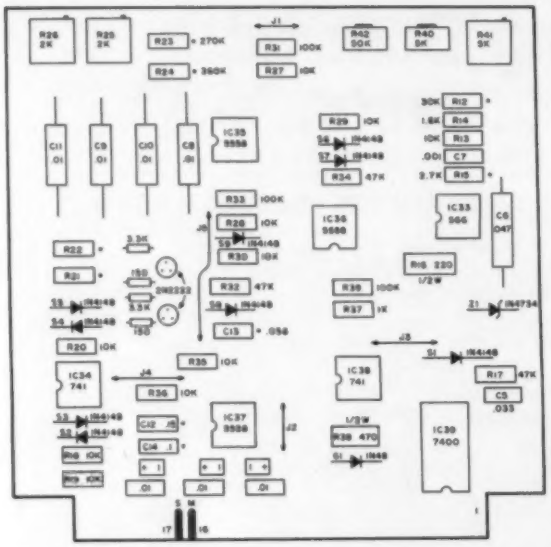


Fig. 3. Modified component layout for Digital Group stand-alone cassette interface.

cleared up that problem.

Adjustment

The power supply was wired up first, and before the circuit board was plugged into the connector (furnished in the kit), a check of the output voltages for proper voltage and no ripple was made. Some ripple was noted on the -12 volt line after the PC board was inserted. This was eliminated by adding the capacitor across the -12 volt bus as shown in the power supply diagram. The alignment instructions provided by The Digital Group data sheets were followed, except that the audio frequencies used were 2125 and 2295 Hz. The unit tuned up without any complications as per the instruction data. Incidentally, I used an audio frequency synthesizer[3] as a standard signal source. This unit generates the RTTY audio tones accurate to within several tenths of a Hertz. A digital counter[4] was used to monitor the adjustments of the VCO.

Operation

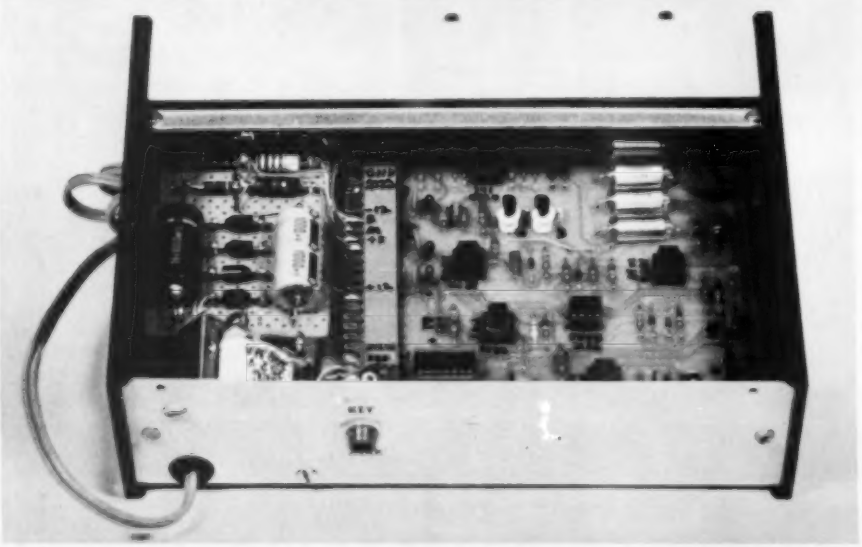
With the RTTY/Computer interface unit connected between the amateur station receiver and transmitter and computer as shown on the block diagram, the HAM-1 tape is loaded into the computer. A RTTY signal (60 speed, narrow shift) is tuned in on the receiver while the two LED indicators on the interface unit are watched. As the receiver is tuned across the RTTY frequency, first one LED will flash, and then both. Then the other will flash on and off. The optimum point is when both are flickering, indicating that both the MARK and SPACE signals are being received properly. A 7-1-1 is keyed on the computer keyboard to tell the computer to set the speed at 60 wpm, receive mode, in upper case letters. The resulting decoded Baudot signals should begin appearing on the video monitor beginning in the upper left-hand corner of the screen.

To transmit the TTY signal, the RESET key is depressed, and when the computer monitor program appears an instant later, the key 8 is depressed. This calls up the computer in the TTY keyboard mode. The transmitter is keyed, and as the keyboard is used, the AFSK signal will be modulating the transmitter in 60 speed, Baudot RTTY.

If the computer is loaded with The Digital Group Tiny BASIC Baudot,[5] the RTTY system is capable of receiving and sending data in the Tiny BASIC format. Listings of games and programs may be sent when the computer is programmed for Tiny BASIC Baudot. Received listings in this format are printed on the TV screen, and if an interface box as described in reference 5 is used in conjunction with this unit, a hard copy can be printed out on the TTY machine. These various modes have been very successfully used here at K7YZZ in receiving and sending both RTTY and computer data on HF to WA7RZW and others.

Conclusions

From on-the-air operation on RTTY and computer data information interchange, it has been noted that as long as you are receiving a strong signal, there is no problem, but when the signal fades, the TU is subject to interference such as CW. The addition of a bandpass filter such as that used in the ST-6 or the DT-600 would help in that situation. Of course, on data transmission you cannot afford an error, so the signal must be very strong with *no fades*. Under those conditions, a bandpass filter is not really required. ■



Inside view of interface unit showing modified Digital Group cassette interface board on the right and power supply on the left.

References

1. "An Intelligent RTTY Station," Louis Hutton K7YZZ, *73 Magazine*, April, 1977.
2. "Standard Cassette Interface Kit," $30, The Digital Group, PO Box 6528, Denver CO 80206.
3. "The Audio Synthesizer for RTTY, SSTV, and Whatever," Dr. Robert Suding WØLMD, *73 Magazine*, July, 1975.
4. "A Modern VHF Frequency Counter," Peter Stark K2OAW, *73 Magazine*, May, 1972.
5. "How to Use Those Old Teletypes," Louis Hutton K7YZZ, *73 Magazine*, February, 1977.

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- - with Extended Tiny BASIC language

Dick Whipple
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In the November, 1976, issue of *73 Magazine*, we described a simple BASIC operating system for use with Baudot teletypes. Although TBX (Tiny BASIC Extended) was satisfactory for beginning programmers, it lacked several features that could be useful for amateur radio applications. Since the November article, we have modified and expanded TBX to include some of these features. The present article describes this new version of TBX which we call TBX-A (Tiny BASIC Extended-Amateur Version).

String Handling Capability

One of the first additions to TBX was string capability. Message handling, logging, and contest operation all require some form of string storage and manipulation. In its original form, TBX only permitted integer variables. TBX-A recognizes both integer and string variables. As with most other BASICs, string variables are distinguished from numeric variables by affixing a dollar sign to the name. For example: A – numeric variable name; A$ – string variable name. Further, TBX-A requires that strings be stored in dimensioned arrays with two characters per array position. Consider the following example:

```
10 DIM A(20)
20 LET A$(1)="CQ CQ CQ DE W5CUD"
30 END
```

After executing the program, the message "CQ CQ CQ DE W5CUD" would be stored in the A array beginning at position 1. Fig. 1 shows the arrangement of characters within the array. A PR (PRINT) command could then be used to output the stored message to the printer (underline indicates operator input). Example:

```
(Direct command mode)
: PR A$(1) CR
CQ CQ CQ DE W5CUD
: . . .
```

The array argument can be changed to alter the beginning of the string. Suppose you only wanted to output the callsign. The PR command above could be modified with the following result:

```
: PR A$(7) CR
W5CUD
:
```

Printing begins at the seventh character pair and continues to the end of the string. In addition, the array positions not used by the original string can be used for other strings or numeric values. Example:

```
: LET A(15) = 1920
: LET A$(16) = "HRS"
: PR A(15)-20;A$(16)
 1000 HRS
: . . .
```

TBX and TBX-A permit the use of two-dimensional arrays. In the case of strings, the second array argument can be used to create separate data blocks with the same variable name. The program shown in Fig. 2 illustrates this technique applied to the creation of logging entries.

The index variable I, used as the second array argument, creates up to ten different log entries. The first argument is used to set up data items for each log entry. The data items, or fields, as they are called, are reserved as shown in Fig. 3.

Fig. 4 further illustrates the two-dimensional storage technique.

When the strings are stored as array elements, they can be further manipulated under program control. In the station log example of Fig. 4, you might want to reorder the file by call area. TBX-A has a string function LEFT(string,n) that creates a temporary string consisting of the leftmost n characters of the given string. By using the LEFT function, the program in Fig. 5 rearranges the log

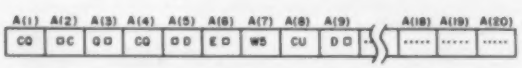

Fig. 1. A diagram showing the storage of a message as a string in array A.

```
10 DIM A(10,10)
15 FOR I = 1 to 10
20 IN A$(1,I),A(5,I),A$(6,I)
30 NXT I
40 . . .
. . . .
: RUN CR
?W2XYZ CR ?1620 CR ?7425KHz CR
?W5UUV CR ?1635 CR ?7430KHz CR
. . . .
```

Fig. 2. Two-dimensional array example.

#	Item	Array Positions
1	Callsign	1 to 4 (Max. 8 char.)
2	Time (GMT)	5 (1 integer value)
3	Frequency	6 to 10 (Max. 10 char.)

Fig. 3. Data items placement within array.

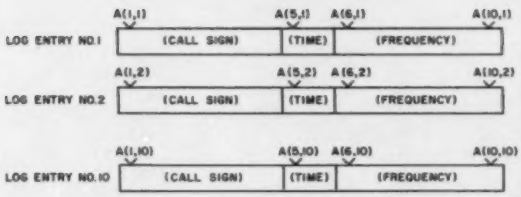

Fig. 4. This diagram shows how two-dimensional arrays can be used to store station log entries. A 10 by 10 array is used to store 10 blocks each, consisting of callsign, time, and frequency values.

file by call area and prints out the result.

Note that the LEFT function is used to extract the leftmost two characters of the callsign, which is the call area. Fig. 6 is a sample run of this program showing the data files before and after reordering.

Ways to Output Strings

Once stored, character strings can then be output to various devices as needed. Output to the local printer is accomplished by the PR statement as in the example program of Fig. 6. TBX-A has two other output modes of special interest in amateur applications:

1. As a RTTY signal to the transmitter; and
2. As a Morse code signal to the transmitter.

Let's consider the RTTY case first. Suppose you have a message such as "CQ CQ CQ DE W5CUD" stored in array A$(1). You are ready to transmit the message over the air as a RTTY signal. On the keyboard, you would type the following command:

```
:XMT(A$(1),100) CR
```

The XMT command in TBX-A has two arguments. The first is the string variable to be transmitted, while the second is a number indicating the rate at which transmission is to take place. Thus you are able to send pre-stored text at any desired speed — even faster than your local teletype. The XMT command can appear as part of a program as well as a direct command. For instance, the message above could be sent several times in succession if the XMT command appeared in a FOR-NXT loop. Consider the short program below:

```
10 DIM A(20)
20 LET A$(1) = "CQ CQ CQ DE W5CUD"
30 FOR I = 1 to 3
40 XMT(A$(1),100)
50 NXT I
60 END
```

After entering the RUN mode, the message would be transmitted three times, one after the other.

To transmit a string via Morse code involves the use of the SM command. It is very similar to the XMT except that the characters of the string are output in Morse code to a single bit (on-off) output port. The appropriately interfaced port in turn keys the transmitter. Thus, it is possible to automatically send a coded message. The example program below illustrates the use of the SM command:

```
10 DIM A$(20)
20 LET A$(1) = "WA5NBQ DE W5CUD"
30 FOR I = 1 to 2
40 SM(A$(1)),54)
50 NXT I
60 SM(" K ",54)
70 END
```

As with XMT, the first argument of the SM command is the string to be sent, and the second is a speed constant. The program above might be used at the beginning and end of RTTY transmission.

Corresponding to the transmitting commands outlined above are two commands that permit you to use the local keyboard as the source of data instead of stored strings. Let's again take the two commands separately. To enter the RTTY mode, you use the following command:

```
:XMD(100) CR
```

At this point, the local keyboard will act as the data source for the RTTY transmission. Each keystroke will result in that Baudot character being transmitted at a speed determined by the single argument of the XMD command. To exit the XMD mode (bringing the local keyboard back to the TBX-A command level), one enters two FGS in succession. Note that the transmitted speed is not limited to the local machine. It can be made faster or slower by simply changing the speed constant.

The second direct transmitting command allows the local keyboard to generate a Morse code signal. In our original version of TBX-A, a keystroke would immediately cause the corresponding Morse code for that character to be sent. We found this to have several undesirable effects. The code generated was not sufficiently regular in

```
 10   DIM A(10,10), T(10)
 . . .
100   LET C = 0
110   FOR I = 2 to 10
120   IF LEFT(A$(1,I-1),2) < LEFT(A$(1,I),2)GOTO 230
130   LET C = 1
140   LET T$(1) = A$(1,I)
150   LET A$(1,I) = A$(1,I-1)
160   LET A$(1,I-1) = T$(1)
170   LET T(5) = A(5,I)
180   LET A(5,I) = A(5,I-1)
190   LET A(5,I-1) = T(5)
200   LET T$(6) = A$(6,I)
210   LET A$(6,I) = A$(6,I-1)
220   LET A$(6,I-1) = T$(6)
230   NXT I
240   IF C = 1 GOTO 100
250   FOR I = 1 to 10
260   PR A$(1,I);A(5,I);A$(6,I)
270   NXT I
280   END
```

Fig. 5. Program for rearranging the log file by call area and printing the results.

	BEFORE	
W2XYZ	1620	7425 kHz
W5UUV	1635	7430 kHz
W1AAC	1810	7420 kHz
W1QRX	1912	7420 kHz
	AFTER	
W1AAC	1810	7420 kHz
W1QRX	1912	7420 kHz
W2XYZ	1620	7425 kHz
W5UUV	1635	7430 kHz

Fig. 6. The two listings show a group of station log entries as first entered and then as rearranged by call area with the sorting program given in the text.

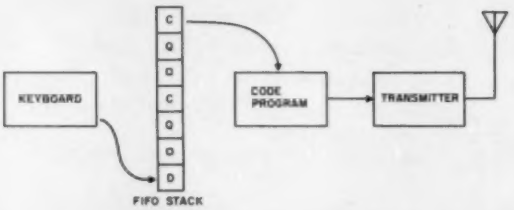

Fig. 7. This diagram indicates the flow of data from the keyboard to the transmitter during direct Morse code operation. The FIFO stack is constantly expanding and shrinking to compensate for different keyboard and code generation speeds.

inter-character spacing, which resulted in copying difficulties. In addition, it caused the operator to type at the code speed (or less), which created a certain awkwardness, especially for people with regular typing rhythms. We then decided that the typing and Morse code generation should be handled independently by the software so that the typist could work at his own speed while the Morse code was being sent with standard character and word spacing. What was needed was a FIFO stack (First In First Out). To illustrate the technique, see Fig. 7. As the keyboard is struck, the Baudot character is placed on the bottom of the stack (actually a group of 72 consecutive memory locations). Each new keystroke "pushes" that Baudot character onto the stack from the *bottom*. The Morse code generation program "pops" or takes the characters from the *top* of the stack and sends the appropriate code to the transmitter. Here is the really important point: the *pushing* and *popping* operations are completely independent and take place at rates determined by the typist and speed constant of the SMD command, respectively. Thus the code produced has an evenness and readability far improved over our original method. Two additional points:

1. When the stack is exhausted (keyboard entry stopped), Morse code transmission also stops; and
2. The buffering action of the stack will only permit the typist to get 72 characters ahead of the Morse generator.

The latter has not been a problem for us, but an overenthusiastic typist could fill the stack. By the way, exiting the SMD mode is accomplished by simply typing a BLANK.

Special Receiving Capability

TBX-A has a couple of receiving modes for RTTY. The first is the RCV mode which is entered using the following command:

:RCV(A$(1),100) CR

The string variable, A$, will receive and store the incoming RTTY message for later printout. The second argument is once again a speed constant. This mode is useful for receiving RTTY at speeds above that of the local teleprinter. We have not found this to be a very satisfactory approach, since the printout is necessarily delayed. Although not yet implemented, we have given some thought to setting up a FIFO stack as mentioned earlier so that receiving at one speed and simultaneously printing at a slower speed would be possible.

Another RTTY receiving mode uses the RCD command. It has the following form:

:RCD(100) CR

The receiving speed is determined by the single argument. In this mode the printer is actively copying the incoming signal, which may be at any speed less than or equal to the speed of the local printer. For instance, if the local machine is a Model 28 operating at 100 wpm, RCD will permit direct copy of 60 or 75 wpm signals by using the appropriate speed constant. Exit from this mode is made by typing a BLANK on the local keyboard.

To date, we have not added any Morse receiving software to TBX-A. We have felt that such capability would be of limited usefulness except when receiving machine-generated code.

That about completes our description of TBX-A. Implementing it on your 8080-based system will not be as simple as some of our other programs like BM/E and TBX. For this reason, we are not making a specific offer for a data package as we did previously. We would prefer that those readers who are interested write us at this address: TBX-A Information, Rt 4, Box 52-A, Tyler TX 75703. We will then make an effort to assist by providing the necessary information at a nominal charge (to cover reproduction costs, etc.). ■

BE MY GUEST

visiting views from around the globe

from page 24

You can buy crystals before you go, or, for some of the more popular hand-helds, you can get them in London and have them netted at about the same cost as you pay here. If you will be mostly in London, you won't need many crystals – no two repeaters are permitted within a fifty mile radius! Just get one repeater pair and one simplex. The London repeater is on Channel R7 – 145.175 in, 145.775 out – and it is just frantically busy about 21 hours daily. Since the timer is just 55 seconds, it leads to fast exchanges – and since most users ID themselves and the other guy with each and every exchange, there isn't time for much else to be said! It is tone burst access; if you don't have tone burst, you can get in for 10 seconds. Oh, yes – if your deviation is too low, the repeater will "time out" on you; if you are too low in frequency, you will get an "L"; if too high, an "H". It also sends a "K" at the end of each transmission. Time-outs are very frequent.

You will hear some rather strange sounding signals because much of the equipment is home-built – current state-of-the-art gear already manufactured such as we obtain so readily here is extremely expensive by our standards.

Language barrier? The UK ham will have no difficulty understanding you because he's largely exposed to rebroadcasts of American TV shows. But you might have a few problems understanding his English – especially since he must rush to get in under the 55 second timer! However, his phonetics are the same as yours – Alpha, Bravo, Charlie, etc.

Remember – plan ahead – and be prepared to prove ownership of your equipment when passing through customs. The best way to do this is by registering it before leaving this country with the Customs office. Last but not least: Expect to encounter more than normal interference from other transmissions when operating over there – interfering signals are plentiful by unlicensed stations.

Warren Geary K9KMX/G5BPL
Hinsdale IL

Reprinted from Squelch Tale, *Bulletin of the Chicago FM Club, Chicago IL, and* Repeater Newsletter, *Bulletin of the Lake Erie ARC, Lakewood OH.*

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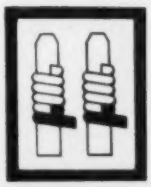

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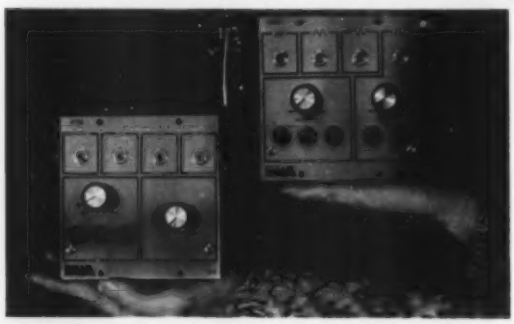

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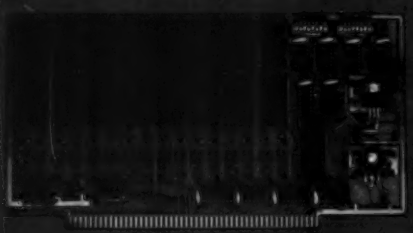

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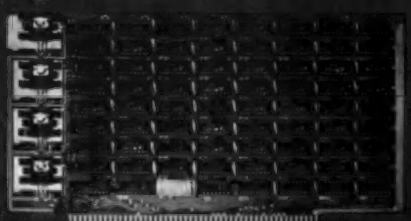

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S22

Satellite Zapper

-- effective antenna for weather birds

Ralph E. Taggart WB8DQT
602 S. Jefferson St.
Mason MI 48854

Antennas for reception of polar orbiting weather satellites can be vexing and complicated affairs. Since the satellites generally track in a north-south direction (actually NNE to SSW for daylight passes and SSE to NNW for evening passes) when near overhead, it might seem that a simple dipole oriented east-west might be ideal, since the satellite would always be in the main lobe of the antenna pattern. Unfortunately, the signal from the satellite is linearly polarized and as the satellite changes orientation in respect to the ground station as it passes overhead, the signal polarization as seen at the ground will vary considerably. The solution, of course, is to use circular polarization, resulting in a maximum of 3 dB of signal loss regardless of the polarization of the satellite signal. This is a relatively small price to pay compared to signal losses of up to 20 dB that can occur with polarization mismatch between the ground station antenna and the satellite signal. The two most common antenna types that are useful for satellite service are the helix and the crossed yagi, the latter with its elements properly phased to yield circular polarization. A helix of four or more turns or a 5 element or larger crossed yagi will do an excellent job, but there is one major price that must be paid for the directivity of such antenna arrays – the satellite must be tracked! This generally requires two antenna rotors (one for azimuth and one for elevation) and precludes picture aquisition when the operator is not present. In a past article in *73*, and in the *Weather Satellite Handbook* (available from *73*), I described an automated satellite station that provides a degree of automatic operation so that pictures can be logged without the operator being present. This system is highly effective but is somewhat complex. If the system is set up for logging daylight passes, it is not particularly effective for evening passes and vice versa. Additional programming can be done to permit automatic tracking of daylight and evening passes and the system is useful for obtaining picture data from horizon to horizon.

In the process of moving into a new house, I decided to take the opportunity to repackage the satellite station to make it somewhat more attractive and, while wrapped up in that project, I also decided to rethink the antenna situation. Now some of the locals around here will say this is because the house was a magnificent Victorian relic with very steep roof lines and that I was simply chicken to risk my skin crawling about doing antenna work. This, of course, is simply not true – the whimpering sounds that drifted down to the ground during antenna sessions were entirely due to our cat, who is deathly afraid of heights. The fact that the cat was never observed on the roof is immaterial! The real reason, of course, is that I needed room up there for the S band antenna system plus the normal complement of VHF and UHF arrays and simply wanted to see if a simpler approach could be made to work. What we ideally want for polar orbiting satellites is an omnidirectional antenna (with circular polarization) that will yield an acceptable

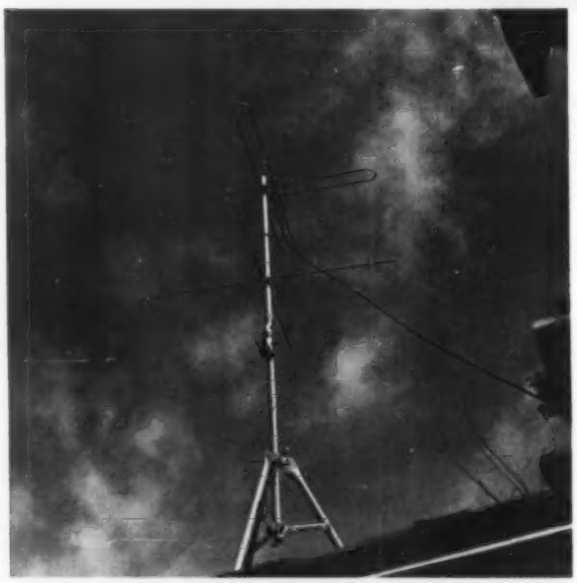

Fig. 1. Photograph of the author's antenna system. The relationship between the phased folded dipole driven elements and the two parasitic reflectors is obvious.

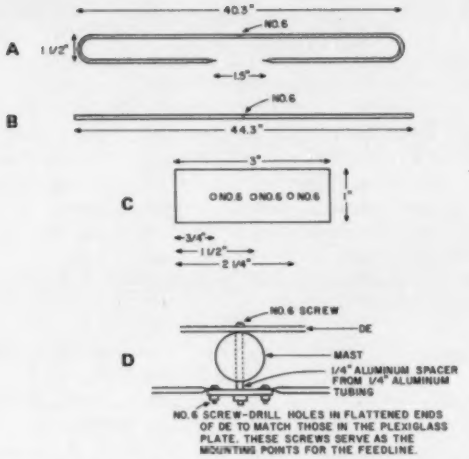

Fig. 2. Antenna element details. (a). Driven element folded dipole fabricated from ¼" aluminum tube. A #6 hole is drilled through the center of the element and 1" of the free ends should be flattened with a 1.5" gap between the ends. Two of these driven elements are required. (b). Details of the reflector element (2 rqd.) of ¼" aluminum tubing. (c). Plexiglas mounting plate (¼" thick) for the free ends of the driven element. (d). Mounting of the driven element to the mast. A #6 screw is placed through the hole in the element, through the mast, and a ¼" spacer is placed over the screw and a nut is attached. Using the holes in the plexiglas plate as a guide, drill matching holes in the flattened end of the elements and secure to the plate with #6 screws.

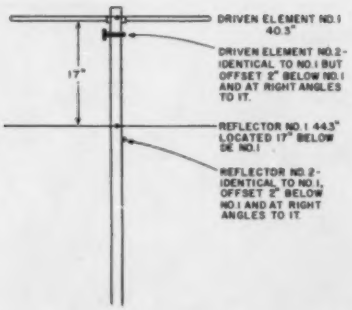
DRIVEN ELEMENT NO.1
40.3"
DRIVEN ELEMENT NO.2- IDENTICAL TO NO.1 BUT OFFSET 2" BELOW NO.1 AND AT RIGHT ANGLES TO IT.
17"
REFLECTOR NO.1 44.3" LOCATED 17" BELOW DE NO.1
REFLECTOR NO.2- IDENTICAL TO NO.1, OFFSET 2" BELOW NO.1 AND AT RIGHT ANGLES TO IT.

Fig. 3. Relationship of the two driven elements and reflectors. The antenna mast is a 5 foot length of 1¼" aluminum tubing. Driven element #1 is mounted 1" from the top of the mast. Reflector #1 is mounted 17" below it with the same orientation. Driven element #2 is at right angles to DE #1 and reflector #1. Reflector #2 is two inches below R #1 and is oriented parallel to DE #2.

signal whenever the satellite is more than 5-10° above the horizon. Such an antenna would be ideal for casual operation with the polar orbiters while vastly simplifying the programming required for unattended operations.

The solution came about by listening to the conversations of the folks using the OSCAR satellites. A number of stations were having considerable success using crossed dipoles (properly phased) over plane reflectors for their 2 meter uplink antenna. Such an antenna is not particularly spectacular for receiving downlink signals on two, but I reasoned that part of the difficulty here was that the OSCAR downlink signal is from a translator and the relatively low satellite transmitter output is spread over a considerable bandwidth, thus reducing signal strength from any one station. The 5 Watt transmitters of the NOAA satellites, however, operate at one frequency and thus the signal should be considerably stronger. Since I had all sorts of parts available for the many crossed yagis I have built at one time or another, I decided to see if the crossed dipole idea would work. Most OSCAR operators place the antenna over a plane reflector – usually made out of screen or hardware cloth – and it seemed that the antenna should work equally well with simple reflector elements, thus simplifying design. Part of an evening was spent putting together the antenna illustrated in Fig. 1, and the results have been outstanding. The satellites can be heard whenever they are above the local radio horizon and the signals are full quieting for most of that time. As an example, a daylight or evening overhead pass should permit signal acquisition for a total of about 21 minutes. Such a pass is audible for that entire period on the omni antenna. My own receiver quiets completely at a signal level of between 8-10 microamps on the S meter, and for over 13 minutes of an overhead pass the meter is pinned at 50 microamps! Watching the meter before and after this 50 microamp interval indicates that the antenna has some lobing to the pattern, or less than perfect circular polarization, but these signal variations are minor and the signal will stay full quieting to very near the horizon. If you have a reasonably sensitive receiver and would like a very simple but effective antenna system for satellite work, read on.

Construction

The antenna elements are fabricated out of ¼ inch aluminum tubing. This tubing size is not critical and even aluminum rod could be used, although the antenna would be considerably heavier. Fig. 2 shows all of the significant dimensions. Support for the two driven elements and the two reflectors is provided by a piece of aluminum TV mast.

Construction begins with the fabrication of the driven elements and reflectors from ¼" aluminum tubing. Bend and drill the two driven elements as shown in Fig. 2. Similarly, cut and drill the two reflectors. Fig. 3 is the guide for preparing the mast. One inch from the top of the mast, drill a #6 hole completely through the mast. Two inches below this hole and at right angles to it, drill another hole. Seventeen inches below the *first* hole,

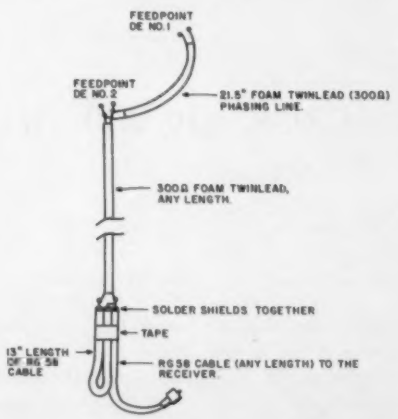
FEEDPOINT DE NO.1
FEEDPOINT DE NO.2
21.5" FOAM TWINLEAD (300Ω) PHASING LINE.
300Ω FOAM TWINLEAD, ANY LENGTH.
SOLDER SHIELDS TOGETHER
TAPE
13" LENGTH OF RG 58 CABLE
RG 58 CABLE (ANY LENGTH) TO THE RECEIVER.

Fig. 4. Details of the phasing line, feedline, and balun.

Fig. 5. NOAA 4 picture readout as received with the omni antenna system and displayed on the author's CRT monitor (the latter is described in the 73 Weather Satellite Handbook*). The portion of the pass photographed extends from Hudson's Bay in the north, south to the central United States. Lake Superior is faintly visible in the lower left of the picture with the lower Great Lakes covered by a massive frontal system that wraps around from the central U.S. up the east coast of the U.S. and southern Canada. Extremely heavy rain was falling as this picture was received, indicating that the antenna performs effectively under adverse weather conditions. The satellite signal remained full quieting until it reached the latitude of central Mexico.*

drill another with the same orientation as the first. Two inches below this hole, drill another at right angles to it (same orientation as hole #2). The driven elements are mounted at the first two holes using Fig. 2(d) as a guide. One reflector is mounted at hole #3 parallel to the unbroken side of DE #1. The second reflector is mounted at the fourth hole, parallel to the unbroken side of DE #2.

Fig. 4 shows the details of the feedline, phasing line, and balun. The feedline and balun are made up from good quality 300 Ohm foam cable. The feedline may be any length and connects to the feedpoint of DE #2 (the lower DE). The 21.5" phasing line has one end connected to the feedpoint of DE #2 with the other end connected to the feedpoint of DE #1 (the upper DE). The feedline should be routed to the shack using good installation practice, i.e., twist the twinlead, use standoffs, and avoid paralleling metal objects such as nearby gutters. The balun is a standard type and should be located right at the receiver. If it is inconvenient to run the 300 Ohm line around the shack, the balun can be used where the line enters the wall or window and the foam cable can be run to the receiver. The 50 Ohm cable should be kept as short as possible, however.

There is no tune-up — simply start using the system. I think you will be very happy with the results. ■

Jim Feeney WA6CLZ
2400 Glenfaire Dr.
Rancho Cordova CA 95670

VHF Noise Snooper

- - track down annoying pulses

Are you quite sure that nothing can be done about that noise level at your QTH? Just one of the problems with noise is its frequency content. I had a noise which affected the FM broadcast band and even wiped out 6m, but only contributed 1/2 an S unit on 75m. So I was forced to look for some special device, and found it sitting right in front of me. Here is a new approach to noise tracing, using a piece of equipment you most likely already have.

Simply cut or unsolder one end of either of the FM detector diodes in an AM/FM portable, and you have an ultra portable, ultra sensitive noise detector. A schematic is usually unavailable for these Japanese sets (there oughta be a law!), but you can usually spot the diodes sitting side by side between the last i-f cans and the audio transformers. Shorting one diode will probably work as well, but I didn't try it.

In use, my detector worked amazingly well. First find a blank spot between stations and start out. I tried using a bicycle, but tire noise drowned out the noise I was trying to locate, so I walk now. As you move, the noise will go in and out like airplane flutter, slowing down and getting steady when you are very near. Then you can point the end of the whip at the noise source for a null. One noise was found so accurately that the vertical position on the pole was pinpointed for the power company linemen.

Of course there are other problems. When you rid the neighborhood of all those power leaks, you really notice the cars. ■

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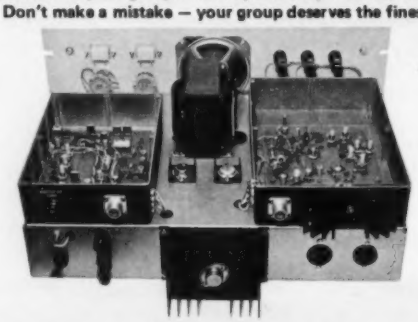

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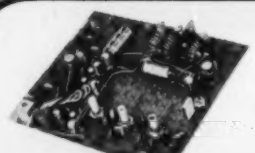

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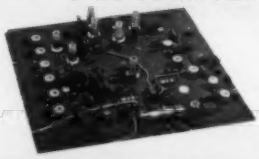

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S8

Bill Hoisington K1CLL
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Understand Your Pet Rock

- - tips on crystal oscillators

This article explains in basic detail how to construct two crystal tester oscillators, how crystals work, the difference between a "fundamental rock" and an "overtone crystal," why you should have a different circuit for each, and what you should know to start with if you are going to do any serious experimenting and/or building at all using crystal frequency control. This subject demands both *experimental work and basic knowledge of sound waves in "rocks" (crystals). Because of the increasing use, worldwide, of "overtone" crystals (such as, for example, "45 MHz" ones for the two meter band which are actually ground for 15 MHz, as you will find when working with them), it is becoming more and more necessary to have a good circuit and to know how it works.*

There has been for some decades a strong push towards ever-higher frequencies due to the space available there, and this force upwards in frequency must of course accelerate as populations and countries develop further.

The lad who plugs a 146.5 MHz rock into an already working *two meter rig does not necessarily need to read this article, but the amateur-experimenter who intends to build his own and wants to* know *what is going on should read it, because that little piece of quartz may be operating with either three or five half waves of* sound *inside its little tin can. Or maybe even seven!*

The use of quartz crystals for controlling the frequency of your transmitter or receiver, and for calibration, is an absolute necessity today even in the most economical types. Even a tunable receiver for amateur use on, for example, the six meter band, should have at least one crystal position for "calling in" for special emergency or net use. These little slabs of quartz operate on the basis of piezoelectricity, in that they expand and contract physically under the influence of electricity, and also *produce* electricity if made to contract and expand mechanically by external forces. A crystal may also act as an "electrical flywheel" or a weighted resonant spring when set in motion at its mechanical resonance frequency, expanding and contracting by an alternating current and/or voltage. There is an ultrahigh frequency sound traveling back and forth through the quartz material, associated with the contraction and expansion, so that the resonant frequency corresponds to the crystal thickness. At 7 million oscillations per second, for example, the crystal thickness is thus paper thin.

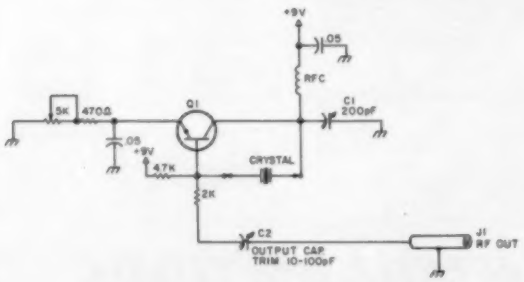


Fig. 1. Untuned crystal oscillator circuit.

When ac (rf) is applied to a 7 MHz crystal, nothing much happens until the frequency reaches 7 MHz. At that time the crystal will oscillate, both mechanically with internal sound waves and electrically with rf waves (these latter rising to several volts if L1 and C1 of Fig. 2 are tuned to 7 MHz). This will tend to hold your transmitter very close to the desired frequency inscribed on the crystal case. Also, if the crystal is used in the local oscillator circuit of your VHF receiver, it will allow your receiver to be tuned to a net or calling in frequency when this crystal is switched in.

Phase Reversal

A little known fact is that

a piezoelectric crystal, generally of quartz for good frequency control, reverses the phase of an rf wave "going through it." Just remember that the Curie brothers, almost one hundred years ago, demonstrated the piezoelectric effect by hitting quartz crystals with a hammer with visible sparks as a result! *Not* recommended at the present price!

At any rate, when the quartz is compressed, positive (+) voltage appears on one side and negative (-) on the other. This feature has a very important and vital usage in the circuits of Figs. 1 and 2.

Fundamental and Overtone Crystals

In order to write this article, I got out my crystal box, which contains over 100 of these little gems representing some 40 years of experimenting with and operating crystal control from 160 meters to X-band (three centimeters).

Going from low frequencies in the HF region around 1.8, 4, and 7 MHz up past about 14 MHz to 18 MHz, crystals change radically in their operation. You will find that from here on up there will be three, five, or even seven half waves of sound inside the quartz material. As I look at the row of crystals I picked out as representative for this article, I find in front of me the following frequencies engraved on their tin or plastic cases; 1.8, 3.9, 6.1, 7.1, 8, 12.5, 14, 18, 21, 26, 28, 29, 45, 50, 60, and 75. Some of these are from before World War II, and some are of the type now sold for as low as 41 cents (U.S.). This latter price, however, only applies when one million are sold at *one time* and on *one* frequency, such as, for example, the color burst frequency near 4 MHz used in TV receivers.

Various "cuts" and types of "optically active" crystals are made which need not concern us here, but we do need to know what kind we should buy and how to use them once acquired. A crystal marked "21 MHz" on the case and plugged into the circuit of Fig. 1 showed plenty of power on 7 MHz, 14, and 21! And quite rightly, too, for this one is ground to 7 MHz and is intended to be used with a tuned circuit of 21 MHz. When on 21 MHz, however, it uses three half waves of "sound" inside, instead of just one. However, do *not* use this for operation on the air with the circuit of Fig. 1, except to learn how it works! To get to *only* 21 MHz output, use the circuit of Fig. 2, which has a tuned circuit on 21 MHz. Going through my crystal samples, another, inscribed 18 MHz, works in both Figs. 1 and 2, because it is cut and ground to 18 MHz and is working on the fundamental. A 14 MHz one does the same, as well as the rest from there on *down* to 1.800. That is, they work in the circuit of Fig. 1. But now let us go higher. A 26.9 job, used in the CB band, shows up right away as being ground for 9 MHz, with power out also on 18 and 27 (roughly). And, continuing upwards and still using the circuit of Fig. 1, just for testing, mind you, and just to show you the principle of multiple half sound waves inside, the next crystal, labeled 30 MHz, shows up with a fundamental of 10 MHz (with power on 20 and 30 as well). Note that the existence of the three half waves (of sound) is due to the extreme thinness of crystals around 15 MHz, and that trying to go further would not be practical. So from there on up we find three, five, or seven half waves inside. The fact that only odd numbers can be used is due to the arrangement of the sound waves inside.

The Circuit of Fig. 1, for Fundamental Crystals

The Fig. 1 circuit is basically an old one souped up for transmitter use. It is quite

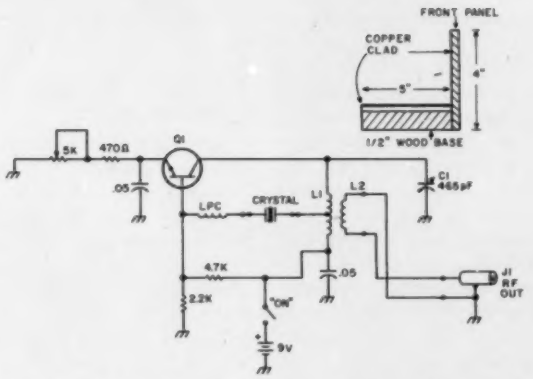


Fig. 2. Tuned crystal oscillator circuit. LPC – phase correction coil (see text). Q1 – see text. C1 – two gang variable, two sections tied. L1 – 6 turns #14 bare copper, ½" o.d., 7/8" long (xtal tap 3 turns from collector end). L2 – 1 turn, semi-adjustable in low end of L1.

a reliable one, with the rock between the base and collector of Q1, using the aforementioned phase reversal to maintain correct drive on the base. However, not having any tuned circuit other than the crystal itself, care must be taken with the component values, current and voltages, output coupling, etc., to get good drive out for transmitter use. Even if you are just going to use it for calibration purposes, you need a "good" oscillator for stability, protection against aging of parts, low battery voltages, and the like.

Construction

I always use copperclad material for the baseboard, because it is easy to cut, solders easily with a 25 Watt iron, and is an excellent ground. Q1 can be almost any good VHF transistor. The one I used was an SE 3001 by Fairchild, priced at less than P2. The crystal "mount" was a pair of alligator clips, because no less than five different kinds of enclosures, all with different pins (and even one with wires for soldering), were among the crystals I tested (some 16 of them, from 1.8 to 75 MHz). You can, of course, use sockets, if you can find the ones needed for the crystals you have.

The choke can be most anything, but should have plenty of small size wire and plenty of inductance. I used a 16 mm o.d. PVC form 8 cm long, with about 200 turns of coil wire wound single layer. C1 should run up near 450 pF for testing (because power output for different crystals and frequencies is helped), but for an oscillator designed for one band only, a mica compression trimmer will do for C1. You will find it very handy to vary R1 for peaking up the power output and tuning up a good oscillator. The 1k pot is in series with a "safety" R2 of 470 Ohms. Don't forget: Transistors do *not* like to operate without some self-bias in the emitter circuit. The output capacitor, C2, can be a trimmer also, such as a 10 to 100 pF.

After assembling and wiring, check with an ohmmeter for proper values of resistors and possible shorts or opens, and then turn on.

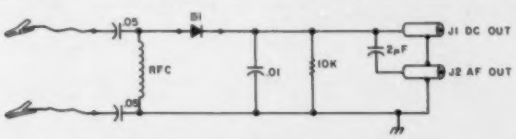


Fig. 3. Untuned diode rf voltmeter.

Using a 7 MHz rock and a 9 volt battery, I found 2 mA of current from the battery with R1 at 3k total and .6 volts rf output into the TD (see Fig. 5 for the tuned diode). A maximum of 2 volts dc from the TD was obtained with an R1 of 1k and 3½ mA of current. Some other crystals gave up to 5 volts or more with everything "peaked." Note that, with only a small value of C2 into the TD, frequency determination is the goal rather than maximum rf voltage indication. In general, for control of a transmitter, do *not* use maximum output. First determine the value of C2 for maximum output, and then *always* operate with *less*. Always run a check on the *minimum* dc voltage with which the crystal will oscillate. This should be *several* times less than the operating voltage.

After checking my fundamental crystals (which all worked well and gave good output in the Fig. 1 circuit), I went up through the 12.5, 14, and 18.3 MHz ones until I hit the one labeled 21.3 MHz. This one immediately showed strong power out on 7, 14, and 21 MHz, indicating that it was an overtone unit. Putting it into the circuit of Fig. 2 resulted in an output of 21 MHz only, the frequency for which is was designed, with the internal presence of those three half sound waves.

Note that output coupling in Fig. 1 is obtained from the low impedance side of the crystal, that is, the base side of Q1. Of course, you can use an emitter follower if you want to be fussy.

Again, remember that the Fig. 1 circuit is for fundamental crystals only, and not for overtones (except to increase your basic knowledge).

The Circuit of Fig. 2, for Overtone Crystals

The same type of copper-clad baseboard and arrangement as in Fig. 1 can be used, with only slight changes in the schematic – but these are quite vital. The use of tuned circuit L1, and the tapping down of the crystal on L1, results in operation on the inscribed frequency, provided, of course, that L1 and C1 are tuned to that frequency.

Operation is as follows. Q1 acts as an amplifier with 50 MHz (assuming you have plugged in the 50 MHz crystal) energy from L1 and C1 feeding back through the crystal to the base, where the desired 50 MHz energy is again amplified by A1, again appearing in amplified quantity on L1, etc., etc. This of course constitutes an oscillator, and a very stable one at that, compared to a non-crystal controlled one. The 50 MHz energy predominates in the output when the proper circuit is used, as in Fig. 2, and care is taken in the tune-up and operation.

Operation

This circuit is for use with crystals of the overtone type, in which the quartz is ground for operation with more than one half sound wave (which makes the presence of a tuned circuit on the inscribed frequency an absolute "must").

Referring to Fig. 2, when assembled and wired, and tested with an ohmmeter for proper resistance values and possible shorts, a milliammeter may be shunted across S1 or put in series with the battery. Some 2 to 5 mA should flow. This will vary with the strength of oscillation, due to the positioning of the FB (feedback) control tap on L1, the setting of C1, and of course, Re, the resistor emitter. I generally connect a 1k variable resistor, known in the trade as a "pot" (potentiometer), in series with a 100 Ohm "safety" resistor to the emitter, and then, after suitable tests to determine the current and overall action desired, I wire in a fixed resistor. However, in this case, for an oscillator designed for experimental testing over a wide range of crystals and frequencies, the potentiometer proved so valuable that it was left in circuit. The Fig. 2 oscillator should now be working.

Two home brew pieces of test equipment are shown, the aperiodic (untuned) diode rf voltmeter in Fig. 3, and the TD (tuned diode) voltmeter and frequency meter in Fig. 4. Both figures contain enough information to enable you to build at least experimental models of these test units. The TD in particular is quite valuable for checking the frequency of an oscillator and the relative powers in the harmonics. Don't forget that almost all oscillators are operating class C and therefore may have strong harmonics. The second and third harmonics are also particularly useful in getting crystal control up beyond 50 MHz. These harmonics are picked out, amplified, and filtered, and then the higher harmonics of the first frequency multiplier are picked out, amplified, etc., etc., resulting at last in crystal control on the radar frequencies (and higher). This requires frequency multipliers, of course.

Referring again to the Fig. 2 circuit, actually the most important of this article, the tuning of C1 and L1 should be done with care. When operating correctly, C1 is not critical, but as you are going to use and test several crystals, or maybe a lot of them, and thus be checking widely separated, it is important to get acquainted with just how a good crystal oscillator works. Don't try to figure out how an oscillator starts! Just assume it is running, and it will be if you follow all details and proceed from there. Insert an overtone crystal, 21 MHz for example, and tune C1 and L1 back and forth through the 21 MHz range. I found good oscillation starting at 2 mA, with about one volt dc showing on the TD connected to the output J1 by a cable of 50 Ohms. "Pushing" the oscillator, by lowering R1 to 470 Ohms, with a total battery current of 4 to 5 mA, caused 3 volts to show on the TD. You can push it even more, to 7 mA, and some 5 volts will show on the TD. However, I just checked the Q1 I was using because it did not start easily, and found that replacing it with an "FCS 9011 H 209" led to much better reliability. So, don't push these little semiconductors too far in power! Note that this type of tester is also useful for testing transistors. Indeed, I generally test out three or four and label them "good 50 MHz osc." or whatever they may be.

Voltmeter readings showed B+ of 8.5; on E there was 1.6, and on the base, 2 volts. Note that the "regular" type of tuning showing on C1 causes gradual rising output as you approach maximum from the higher C side, and an abrupt cutoff of oscillation as you pass the maximum peak on the low side. Fig. 5 shows this curve, which is the

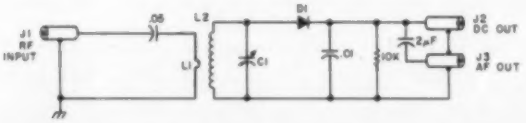


Fig. 4. Tuned diode rf voltmeter. L1 – 1 turn. L2 – to suit frequency. C1 – 465 pF.

Fig. 5. Tuning curve of C1, Fig. 2 (without LPC).

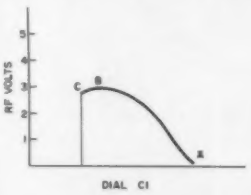
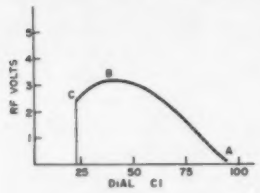


Fig. 6. Tuning curve of C1, Fig. 2 (with LPC).



normal and correct type for an overtone oscillator. Get used to it, and note that for reliable starting you should not operate on the peak at C. Use some position near B, as you will find in a short session of trials by turning the battery switch on and off and watching the output. Note that Fig. 5 is just one curve that I found here using a 45 MHz rock designed for two meter (146 MHz) work, and different crystals and transistors (and different feedback taps on L1) may show somewhat different curves.

A very interesting addition to Fig. 2 can be made as follows. A small coil of fine wire, some 40 turns on a matchstick, 4 mm long by 2 mm diameter, can be added simply in series with the crystal, on either the base side or the coil (L1) side. The effect of this coil (labeled "LPC") is quite interesting. It corrects the phase shift through the collector-L1-crystal-base path, and results in stronger oscillation and easier and more reliable starting. It also shows up in a much more uniform curve when plotted as in Fig. 6. The tuning will no longer show an abrupt drop on the low C side. Trying out several sizes of these "phase correction coils" will show you quite a bit about phasing in oscillators.

Checking out the rest of my VHF crystals, the operation was similar, although on 75 MHz oscillations did not start until I used some 2½ mA on the oscillator. ■

TTL Techniques

- - bypass those glitches

William Browning WB5IRY
516 N. 95th E. Ave.
Tulsa OK 74115

TTL logic is one of the most popular of all logic families. One reason for this is that it will almost always work even when the circuits that are in use are of poor engineering design.

If you saw some of the experimental circuits that I have put together, it would be obvious why I like this feature. But TTL, like all electronic devices, will at least be more reliable if proper engineering design is used.

What is proper design for TTL? I wondered this same thing for a long time. If you would like to know some of what I found out, read on.

The (Vcc) supply voltage for TTL is +5 volts and should be well regulated, with ripple of less than 5%. If you are using a large system, a low inductance power busing system is recommended.

Every circuit board should have decoupling capacitors — at least one for every 5 to 10 TTL ICs, and one for every flip-flop. These should be .01 uF to .1 uF rf bypass capacitors with short leads. There should also be at least one 2 uF to 20 uF on each board. For a general rule, the more capacitors, the better.

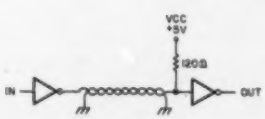


Fig. 1.

A good ground bus should be used whenever possible (essential for large systems). Better yet would be the use of a ground plane. Stay away from using open wire connections for grounds.

Use printed circuit board construction for all circuits, and stay away from hand-wired construction. IC sockets are fine most of the time, but they may cost more than the ICs that they hold.

Don't follow the common practice of leaving unused inputs floating. Though they do normally assume a logic 1, they also act as an antenna for noise and the floating input may go to a logic 0 at any time. You may tie inputs to ground for a permanent logic 0, or to Vcc through a 1k Ohm current limiting resistor for a permanent logic 1. One current limiting resistor can be used for up to 50 inputs.

If you have any unused gates, it is recommended that the output be forced to a logic 1 by tying of the inputs. This will give lower power dissipation and you can use the permanent logic 1 for the tying of other gate inputs.

When open wire connections become necessary, they should not be routed together. They should be kept as short as possible. If long runs of wire are required, it is best to use twisted pairs. One possible way to drive a long run of twisted pairs is shown in Fig. 1.

The next time a TTL project does not seem to work right, or works right only part of the time, check it for the engineering design. You just may find the problem.

If you are doing design work yourself — and what project-building ham doesn't? — just eliminate some of the possible problems to start with. ■

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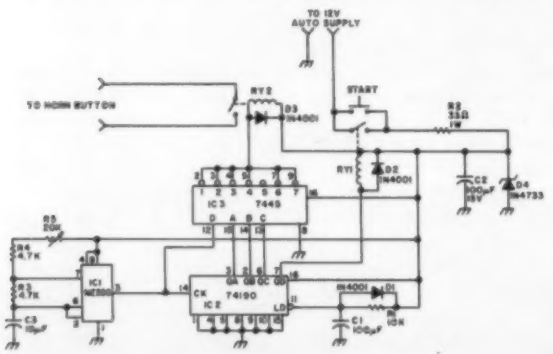
Ashley OH 43003

Sending HI

- - on the hooter

Remember the good old days when hams would toot HI, in Morse code, on their automobile horns when spying one of their cohorts? Why don't they do this any more? Is the dastardly rumor true? Don't hams know the Morse code or has that esprit de corps, peculiar to hams, gone the way of home brew rigs and sunspots? The little goody described herein won't bring back the sunspots but will put you on the road to home brew rigs and will allow you to send HI on your automobile horn with just one push of your pinky. This unit utilizes electron flow to accomplish this worthy purpose. You remember electrons, don't you? They're some of that electricity stuff.

This circuit can be divided into four main sections: an oscillator (IC1), a counter (IC2), a decoder (IC3) and a power supply latch and regulator. The oscillator rate and the rate at which you send HI can be adjusted by R5. I found that after I had used the unit for a short while, I didn't want to adjust the rate any more, so R5 might just as well be a trim pot hidden out of sight. The start push-button is the only thing that needs to be accessible.



When the start push-button is pushed, 12 volts from the car battery is dropped through R2 and regulated to 5.1 volts by the zener D4. C2 keeps any noise from the automobile system from causing problems as well as providing a low impedance power source for the ICs.

When 5 volts is applied to the ICs, the network of R1 and C1 causes the voltage on pin 11 of IC2 to rise more slowly than the supply voltage, and thus performs the function of clearing the counter to all zeros. The diode D1 causes the capacitor C1 to discharge rapidly when the power is removed so that the circuit will be ready for a new cycle of operation very soon. With the output Q_D in a low state, the relay RY1 is energized and the 12 volt power is maintained to the circuit even though the start push-button is released. The oscillator performs two functions. It advances the counter every time the oscillator output makes a low to high transition, and it enables the decoder whenever the oscillator output is high. Since the oscillator output spends half of its cycle time high and the other half of its cycle time low, the counter retains a particular count for a complete cycle of the oscillator while the decoder IC3 is enabled for only half of the cycle time. This provides that each dot will be followed by a space of equal duration. As the counter starts counting up from zero, the decoder outputs go low one at a time. The output corresponding to the count in the counter activates relay RY2 and the relay contacts toot the horn. Only the first three bits of the counter are decoded and the outputs 1 through 7 are the only decoder outputs used to activate RY2. Output 5 is not used and this is the space between the H and the I. When pin 12 of the decoder goes high with the oscillator output, the decoder interprets this as a number greater than 7 and none of the outputs connected to RY2 can go low. When the counter goes to a count of 8, output Q_D goes high, which releases RY1 and removes all power from the circuit. This means that you can leave this unit connected to the car battery all the time since it only draws power when it is in actual operation (which means this design is ecologically sound, whatever that means). If you hold the button down, you will send HIs ad nauseam. ■

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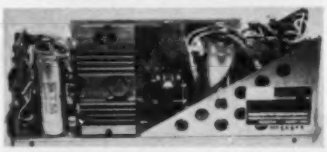

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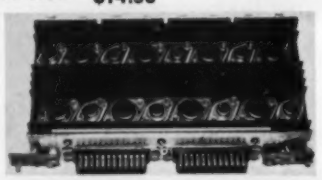

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15735 E. Brown Ave.
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Build a DDRR for Your Mobile

- - this one won't blow off

When I moved to a new mobile home park a few years ago, a new and formidable kind of antenna problem faced me. The park rules forbade my normal array of antennas. After sitting around lusting for forty meter phone for a while, I decided forty meters wouldn't be the same without me, and I had to do something to get back on the air.

I tried the usual non-working, "invisible" wire antennas with 10:1 swrs, and a home brew joy stick that was tricky to load and produced rf burns at the microphone (it is hard to enunciate with Band-Aids on the lips), but it was obvious – there had to be a better way. There was. I discovered, in a June, 1970, *73 Magazine*, the DDRR (Discontinuous Directional Ring Radiator) antenna.[1]

The first thing I had to consider was what size DDRR would be needed for forty meters. My calculations produced a height of twelve inches and a diameter of nine feet. Just right for my twelve-foot-wide mobile home! And I had another bonus: The home roof was metal and would make an ideal ground plane for the antenna. I had only to supply the radiating element, and bingo – on the air!

The next thing I had to do was convince the park officials that an antenna only one foot high sure wouldn't look like an antenna. Subsequent conversations with the park manager produced permission to put it up, since, "It sure wouldn't look like an antenna." We had reached an understanding. Construction proceeded at full speed.

I had lots of ½ inch copper tubing left after setting up my home in its new location, but not enough to make a complete antenna. A trip to the hardware store produced a few more feet of tubing, an in-line coupler, a tee-coupler, and a deep appreciation for the similarity between the price of copper and gold. I put all the copper under lock and key until the antenna went up.

Since the antenna radiator wasn't self-supporting, I had to design a framework to hold it in position. PVC tubing is rather cheap, and since I am too, another trip to the hardware store produced a PVC four-way connector, several ten foot lengths of ½ inch i.d. PVC tubing, and four right angle PVC connectors. The four-way connector was the center of the support structure. The PVC pipes, cut to 4.5 foot lengths, were inserted into the connector. Holes were drilled through the connector limbs and pipe, and 6-32 screws were inserted through the limbs and pipe. This prevented the pipes from twisting in the connector. The right angle connectors, after being mounted on the four pipe sections, were squared vertically and drilled through. 6-32 screws were inserted.

The PVC uprights, twelve inches long, were cut with a hacksaw to form slots on the end to hold the radiator while the other end was pushed into the right angle connector. The antenna was now ready for final assembly.

All the parts were collected on the roof after the copper tubing sections were joined and bent into a first order approximation of a nine foot circle. On the ground, the tubing measured 27.2 feet with a one foot discontinuity, but after carrying it up the ladder, the roundness became more approximate. A copper tee-section was soldered to a copper tube with a flattened section bent at a right angle to the rod. The distance from the bend to the tee-section was twelve inches. The radiator was placed on the supports and re-rounded to take out the strain on the supports. The whole arrangement was centered on the roof. The copper upright was soldered to the main radiator, and a hole was drilled through the flattened section on the upright and the roof. The contact area of the flange and roof was cleaned carefully on both metal surfaces, and a large sheet metal screw run through both. The connection site was caulked and covered with putty and painted with some roofing paint.

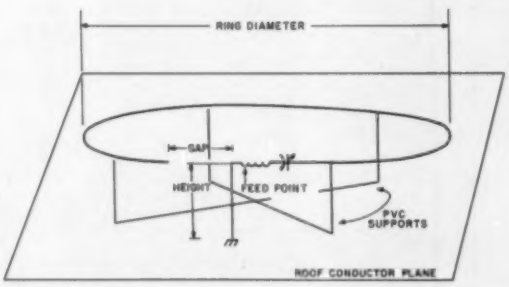


Fig. 1. Schematic layout of the final antenna and support parts. The PVC four-way connector is located in the support center. The right angle connectors form the upright bends.

Nylon lines extending from the center of the support frame (the four-way connector) to some convenient tie points on the roof held the assembly in place. The wind wouldn't blow this project away, and where I live you have to think seriously about such things.

A variable capacitor of about 100 pF was placed on the end of the radiator at the discontinuity, and the other plates on the capacitor were grounded. An SO-239, mounted near the base of the copper upright, was connected to the antenna via some solid copper wire. Last of all, the rig was brought up on the roof, along with some power, lights, and a real sense of anticipation. Now was the moment of truth.

An swr meter was inserted in the line close to the antenna, and the rig was turned on. There was a little noise coming from the speaker, but not much to cheer about. I tuned the capacitor, and suddenly I could hear good, loud signals coming through. The tuning was sharp, but boy did it work!

I loaded the rig into a fifty Ohm dummy load, connected it to the antenna again, and inserted some carrier. The roof lit up like Broadway, with a bluish cast. My capacitor was a beacon in the night as rf buzzed between the plates. The capacitor was the correct value, but the voltage rating was far too low.

I started a search into every junk box I was privy to. No dice. Seems no one uses high voltage capacitors any more. With transistors and two meter FM, high voltage capacitors are joining the dinosaurs in extinction. The alternative was to make one.

Choosing the sturdiest-looking peanut butter jar in stock (I save such things), I mounted a long screw through the lid, put a foil-covered paper cup on the screw head, and dropped the whole thing inside the jar.

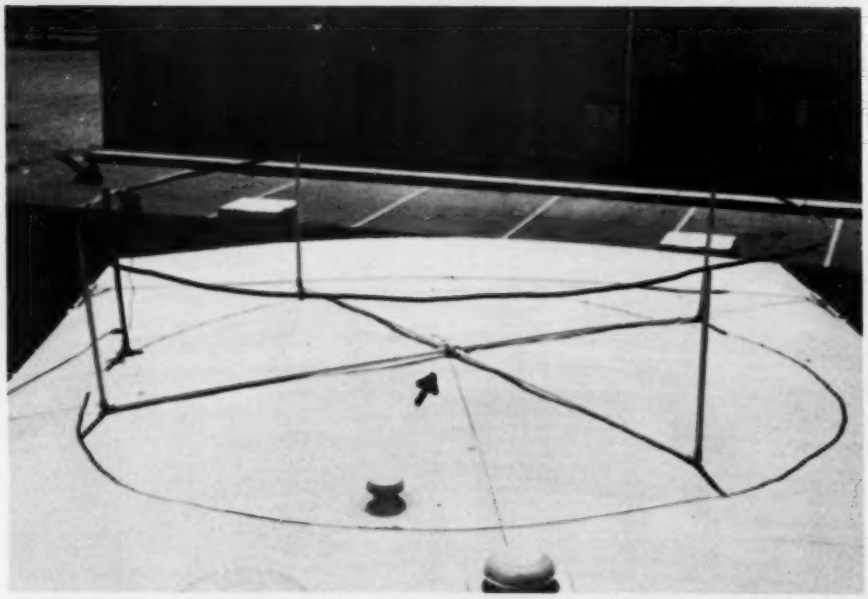


Fig. 2. Final DDRR positioning on the roof. The antenna is two feet high. The tuning capacitor and coil can be seen on the left. Nylon lines run to the PVC four-way connector in the center.

The outside of the jar was covered with foil, and connection to the foil was made with some copper wire twisted around the foil on the jar. I mounted the capacitor, tuned it, and, joy of joys, it worked! A great sense of foxiness overwhelmed me, and I bragged wildly to my XYL for fifteen minutes or so before returning to my triumph on the roof.

I tuned up the transmitter, and applied a little power to the antenna again. The swr was about 10:1, but that could be adjusted later, I thought. However, I had second thoughts about it and brought the swr down to 3:1 by changing the tap point on the antenna. At about fifty Watts into the final amplifier, the whole thing cracked like a rifle. I ducked and headed for the power switch. The capacitor was shattered as if it had been hit by a hammer. As I looked at my broken success story, it started to snow, and it really became imperative to get off the roof before the rig and I both slid off. The moral of this short story is that a lot of voltage appears at that discontinuity, so have a healthy respect for it. Capacitors at the discontinuity had better be able to handle 3 kV or more.

Fortunately, my reference for this project didn't let me down. It described another loading technique, and, since I had put more than my weekly allowance into the copper tubing, I wasn't about to quit now. Besides, I was getting questions from the neighbors about my new solar heating unit on the roof. I smiled knowingly and talked about heating the world.

Meanwhile, my junk box yielded some three-inch-diameter B & W stock, and a call on two meters produced a nice 200 pF variable from a very disbelieving ham. I disconnected the tee-section from the radiator and inserted a PVC section into the gap for support. The coil was soldered to the tee-section and the variable capacitor, after the capacitor had been mounted to the radiator with some machine screws. The combination formed a series-tuned circuit and provided a handy tap point for the coax. This technique isn't as efficient as the one which lighted the sky, but the tuning capacitor sees smaller voltages which are more manageable. The final arrangement is diagrammed in Fig. 1.

	10	15	20	40
Ring Diameter	28"	40"	54"	108"
Antenna Height	3"	4.75"	6"	12"
Discontinuity (Gap)	2"	2.5"	3"	5"

Table 1. Dimensions for other bands.

The resulting combination tuned easily, with the characteristic sharp increase in noise at resonance. The coil was then stepwise shorted, and the capacitor tuned to provide the highest C to L ratio with a little room for tuning. Some ten turns of coil remained unshorted.

The final tuning process was a combination of tuning for minimum swr and moving the tap point until the returning energy was minimum. I ended up with no measurable reflected swr at resonance. It pays not to hurry through these adjustments.

Set the resonant point at your favorite spot on the band (you are building one, aren't you?) and don't expect to stray far beyond that. The

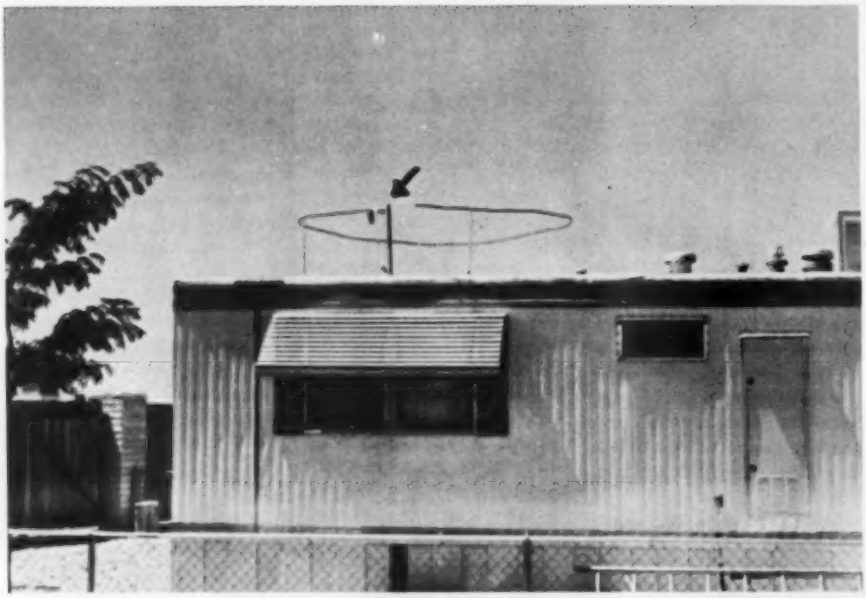


Fig. 3. The elegant look of success: the DDRR on the roof. Vertical portion of the radiator and tuning section are quite visible. Call it a solar heater.

final adjustment provided about 40 kHz of operation around 7250 kHz for a vswr measured at 2:1 or less. Considering the alternative of no operation, I viewed this as only a minor annoyance.

The antenna has operated at this QTH for over a year and a half and has satisfied the objective of keeping me on the air. Plus, it has proved to be quite a stimulant to conversation during QSOs. There is always the suspicion, with any antenna you build, that it's really just heating the air rather than radiating electromagnetic energy. This antenna, too, has fallen under that suspicion, but every time my doubts have risen, the DDRR comes through with a nice solid contact into eastern Canada, or Puget Sound, Washington.

I recently put up a temporary vertical for forty meters and tuned it for an swr measured close to 1.1:1. Switching between the two antennas produced a real surprise. The DDRR worked as well as the vertical for getting the signal out, and reported signal strengths for both of them were indistinguishable. However, the DDRR proved to be exceptionally quiet! A noise level of S5 or S6 on the vertical was S1 to 2 on the DDRR, but the received signal levels were identical.

I have worked both coasts with 5/9-plus reports, with 60 to 100 Watts PEP at the antenna. I have worked mobiles others cannot hear because of the QRN. On my vertical I can't copy them either, but they are Q5 and S2 on the DDRR.

My vertical sits in the corner a lot of the time now, awaiting portable or emergency use. The DDRR sits on the roof at dc ground potential (no static electricity buildup from the wind) and won't blow away, and if I get a little more inventive, remote tuning will let me walk all over the forty meter band.

Fig. 2 shows the final positioning of my little gem on the roof. The PVC support system can be easily seen. Fig. 3 gives an idea of how the antenna could appear on your home. In case you are interested in other bands, some suggested dimensions are shown in Table 1.

In the December, 1975, *QST*, John Belrose analyzed this kind of antenna, and, from the analysis, he has suggested a new name for it.[2] I ignored the name (apologies to John) and moved to a very instructive graph that plotted the height of the antenna in degrees versus radiation efficiency. That graph, plus some thinking on my part, produced another antenna party on the roof, this time to raise the whole thing another twelve inches. Doing that, according to the graph, would (could) raise the radiation efficiency some 4-plus dB. Everything went up a foot. The results have been gratifying, with fewer CQs and calls in the log that have a "no QSO" notation.

For those hams who live in mobile home communities with antenna restrictions, this kind of antenna might get you back on the air. I can vouchsafe one product of building and tuning such an antenna: You will end up knowing a great deal more about antennas than when you started the project. ■

References

[1] English, W. E., "A Practical DDRR Antenna," *73 Magazine*, issue 117, page 20, June, 1970.

[2] Belrose, J. S., "Transmission-Line Low Profile Antennas," *QST*, page 19, December, 1975.

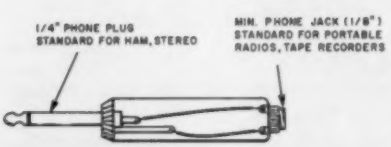
David Naatz WAØVHX
RFD 5, Box 237
Austin MN 55912

Headphone Jack Adapter

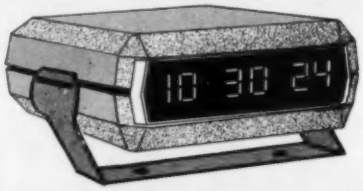
Have you ever bought a good pair of headphones for your ham set that work with your AM/FM radio or tape recorder, only to be confronted with a monstrous ¼" plug? Well, here is a setup that may help.

This is also a handy adapter to have lying around for that "once-in-a-lifetime" chance that you won't have a speaker or headphones and want to get on the air.

That happened to me as I came home from college, but forgot to bring home a speaker or 'phones. I used this adapter in conjunction with some 2,000 Ohm earphones that I had used with an old Japanese transistor radio. ■



DIGITAL AUTO CLOCK



The heart of this chronometer is a high frequency crystal oscillator which provides an accuracy of ± 1 minute per month even in changing temperature or electrical "noise" conditions. Easy to assemble kit with complete step-by-step instructions. Or, for those who would rather not, a ready-built and tested unit is also available.

FEATURES INCLUDE:

12 or 24 hour time format — Displays time in hours, minutes, and seconds on 6 large, .4" red LED digits — Operates from 9-14 volts AC or DC power — Simple, non-polarized power input — Display blanks when ignition off — Internal 9 V battery assures timekeeping (without display) when external power is removed — Special circuitry surpresses voltage spikes — Recessed switches in front of case for quick and easy time setting.

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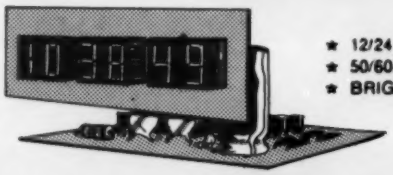

- ★ 12/24 HOUR
- ★ 50/60HZ
- ★ BRIGHT LEDS

This kit uses the MM5314 clock chip and is available with a choice of display sizes. Features 12 or 24 hour time format, 50 or 60 Hz input, fast and slow time setting with a hold function for precise time syncronizing. Kit includes all components, etched and drilled epoxy boards and complete step-by-step assembly instructions. (Case and transformer not included).

Kit #SI-10 with .27" Red LED's	$11.50
Kit #SI-14 with .4" Red LED's	$13.95
Kit #SI-15 with .5" Red LED's	$16.95
Transformer to suit. (pc lug mount type)	$ 1.25
Transformer to suit. (molded with line cord)	$ 2.50

60 HZ CRYSTAL TIME BASE

This kit enables any AC powered clock to be operated on DC. Compact size — only 1" x 2". Power requirement: 5-15 VDC @ 3 mA. Kit includes all components, PC Board and easy to follow hookup instructions for interfacing with MOS clock chips.

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CLOCK CHIPS

MM5314 - 6-digit, 12/24 Hr, 50/60 Hz Multiplexed, 24-pin	$3.75
MM5316 - 4-digit, 12/24 Hr, 50/60 Hz, Alarm, Snz, Timer, 40-pin	$4.50
50252 - 6-digit, 12 Hr/60 Hz, 24 Hr/50 Hz, Alarm, Snz, Mpx., 28-pin	$4.95
CT7001 - 6-digit, Clock, calendar, Radio Timer, 12/24 Hr, 28-pin	$6.95
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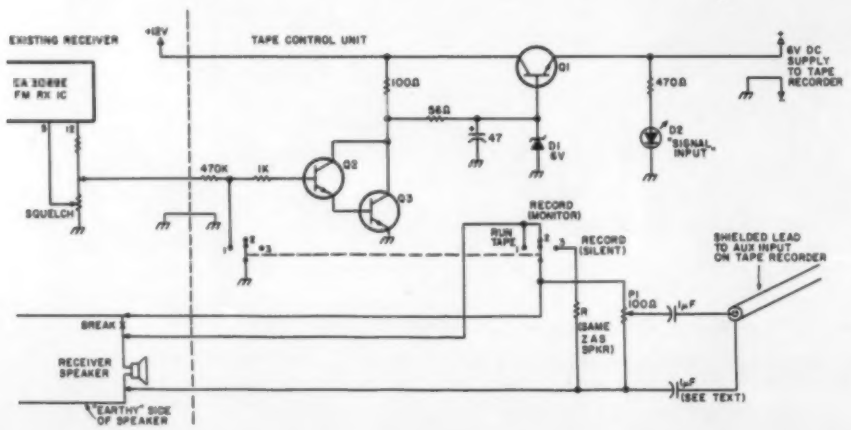
Automatic Taping Unit

- - for repeaters, logging, etc.

This unit has been developed for sticky-beaking on selected FM channels. It has a number of useful functions for the experimenter.

Basically it is a unit for turning on a tape recorder whenever an input signal is received by the receiver and turning the tape off again when the signal goes off — after recording the audio from the transmission. Applications are many. The local repeater can be monitored unattended. Information such as daily usage rate, overnight use, callsigns of all users and so on can all be analyzed. It enables an experimenter while out mobile to hear his signals replayed when reaching home. Other stations can leave messages for you with this system.



The tape recorder used is a cheap cassette with autostop. The autostop is a desirable feature so that the recorder turns itself off when the tape has run out. The circuit could be adapted to other types of recorders. A 6 volt dc supply is necessary for the recorder used in the example described here. This supply is obtained by a series regulator Q1 and zener diode D1 from the 12 volt receiver supply.

Transistors Q2 and Q3 are a Darlington pair which, when conducting, effectively remove the base supply for Q1 and turn the tape off. If the base of Q2 is positive, the tape is off. If the base of Q2 is at earth, the tape operates.

The receiver in use has a CA3089E in the i-f tail-end. Connection to the mute (or squelch) circuitry is as shown in the diagram. Other receivers could be connected up in some similar way. The 47Ok resistor and Darlington connection of Q2 and Q3 ensure negligible loading of the squelch circuitry. No mechanical relays are necessary.

The control switch in position 1 enables the tape recorder to be run for rewind and replay. The LED gives visual indication of an input signal entering the system. This is of use when recording in the "silent" position of the control switch.

Audio from the receiver is taken from the speaker circuit and fed to the input of the recorder. A resistor (of the same impedance as the receiver speaker) is switched into the circuit when the control switch is in position 3. This keeps the shack silent during unattended recording. In positions 1 and 2 of the switch, the receiver speaker is active. The receiver speaker monitors receiver activity

during rewind and replay to ensure that nothing is missed!

Potentiometer P1 sets the audio to a suitable level for the recorder input. The receiver audio gain control must have already been set for comfortable room listening. The two capacitors in the audio leads to the tape recorder input are necessary to ensure complete dc isolation of the receiver from the recorder. Some recorders are positive earth, while most receivers are negative earth. Provided that this problem is recognized and investigated with appropriate steps taken if found to be necessary, then no difficulties should arise. My recorder is positive earth, but it is in a plastic case with few metal protrusions, so the whole thing "dc floats" quite acceptably.

This monitoring system has been running successfully for some years now and has been useful for keeping up-to-date with current happenings on the channel and for testing purposes. It is much more acceptable to record your own signal when testing or developing transmitters and hear it later yourself than to rely entirely on verbal assessments from other operators.

Transistor Q1 is an NPN power transistor. Q2 and Q3 are NPN small-signal types. There are so many suitable types of transistors available for these applications that no type numbers are quoted here.

This tape control system is also useful when out mobile. It can be run quite conveniently in a car. When the vehicle is parked, it can be set operational, and you can soon learn if someone has called you during your absence.

Construction is not critical in any way and any suitable board or box or chassis will be suitable. Junk box parts will invariably be found to be appropriate!

Good luck and good listening!■

Gabe Gargiulo WA1GFJ
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East Hartford CT 06118

Let's Use English

- - for a change

CBers are known for their CB lingo, the jargon they like to use. They use a handle – a nickname that they use only on the air, like "Red Baron" or "Big Breaker." Their language is colorful: "18 wheeler" instead of "truck," "10-4" instead of "OK." There are even dictionaries of CB slang being published.

As far as I am concerned, this is foolishness. CBers are people talking to other people – why shouldn't they use the same language as everyone else?

We hams are almost as bad. Our peculiar language includes such things as "What's your QTH?" or "Thanks for the fine Q sew." Most of our contacts involve a lot of jargon, but we manage to get some English in, so listeners can at least tell what language we are speaking.

There was a time when ham talk had its place, on CW. Abbreviations and short cuts are the order of the day on CW, but to carry them over into speech is silly. The only reason we keep using a peculiar form of talking is that it sets us apart, it makes us a select group, with our own practices.

I propose that we stop using oddball terms like QTH, QRMary and XYL, and stick to terms that we have understood since childhood, like hometown, interference, and wife. As a group we have nothing to set us apart. Oh yes, we all managed to pass a code and theory test that wasn't that much of a challenge; then we went out and bought our rigs, set them up, and started talking. We're not really into this radio thing too technically. If we were, I could understand us talking shop, using technical terms.

Why did we get into ham radio at all? To join a group that is set apart by its strange practices, or for the thrill of being able to talk with some one across the state while seated in our car, or across the world from the home station? I think you know why. So what happened? When we first became hams we wanted very much to join the group and be like everyone else. So we imitated what we heard. We adopted the practices we heard on the bands. We learned to say "The QTH here is . . .", "The handle here is . . .", "See you further on down the log." That gave us a feeling of belonging, and made us feel like old pros on the band.

Now that CB has become the latest national fad, and its weird ways of talking are being heard on the streets and on TV, many of us hams have seen how silly it is and how little we need our own peculiar jargon. We can make sense to each other by using everyday English, the same language we use everywhere else. So how about it? How about going up or down in frequency instead of QS whying? "Further on down the mike cord" should become "Some other time." Let's lay QRMary to rest, alongside QRNancy. No more talk about XYLs or Q sews. Come on, hams, let's hear it for good old standard English! ■

Jack Grimes W4LLR
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Memphis TN 38116

The Ham Radio Classroom

- - sure beats study hall

I shoved the key in the lock and twisted. Then I put my shoulder against the panel and kicked the bottom of the door with the heel of my shoe. It opened with a groan. That door, like everything else at Riverside Vo-Tech High School, was badly in need of repair.

Heels clicked on hard tile. I paused, turned, and gazed as the chic YL figure passed.

"Hi," she tossed a breezy greeting.

"Evening," I managed to get out.

She continued on down the hall, hips swaying provocatively. I pursed my lips in a soundless wolf whistle, and fumed at myself for acting like a high school freshman.

I was there that evening to get my ham rig set up and checked out for class demonstrations the next day. I had no idea what Leigh Wainright was doing in the building. For that matter, I had never been able to figure out why a dish like Leigh was teaching Home Ec in a crummy school like Riverside.

I turned back toward my room. It was hard to realize only two months had passed since I accepted the job as electronics instructor, and had my name, Kenneth Cook, inscribed on a cardboard tab over the door.

My eyes took in the familiar scene. Tables and chairs in the middle of the room, where students were supposed to study and take notes. A bench down each wall with a few test instruments, mostly government surplus. Junk TVs and radios, which should have been scrapped years before. And a green portable chalkboard, covered with illustrations and basic formulas.

Maybe, just maybe, I thought, I could get those kids interested in Ohm's Law or how to make a good solder joint, if I showed them how much fun ham radio could be.

So far it looked as if trying to teach them anything was a waste of time. The school was practically an armed camp, where keeping a semblance of order was the major task each day.

Although teaching jobs were not plentiful, I could have been working elsewhere, either as an instructor or technician, for more money than Riverside paid. But I had chosen to hunt a position in an urban poverty area school where I felt I could be of service — maybe help some of those less fortunate find a better life.

And what career was more wide open than electronics, in this day of integrated circuits and microprocessors.

As I thought, I kept busy, securing the coax I had strung the evening before from a dipole on the roof, along the wall. I had decided to set up on 40. A 2 or 6 meter rig would not impress the kids as much as talking to someone at a distance. 20 was too crowded with no beam. 40 looked like the right compromise between distance and reliability.

I made the final connection between my transceiver and home brew linear, plugged in the mike, and flipped a switch. I found an open spot on the band and checked the swr.

A "5" called a short CQ. I went back to him.

My cares and worries dropped away. No matter how down I was, I could fire up a rig and forget my problems. It had always been like that, even when I was a kid playing with crystal sets and code practice oscillators.

I had my General before I was fifteen and nothing, absolutely nothing, had ever come ahead of hamming. This included girls, which was probably the reason I was still single at the ripe old age of twenty-four.

I was right in the middle of a long-winded explanation of what I hoped to accomplish at the school when my door rattled violently.

"Wait one, Joe," I spoke into the mike and across three states.

A lift and pull at the door was necessary from the inside, before it opened. I looked into a pair of blazing violet eyes.

"Mister Cook," Leigh Wainright exclaimed. "We're trying to watch a slide presentation, and all we can hear on the sound system is you!"

"Sorry."

I had learned long ago there was no use arguing with anyone, especially when they were angry, concerning TVI, BCI, or any other kind of interference. "Just give me a minute and I'll sign off."

She nodded and I ended the QSO briefly.

"I'll have to work on the sound system," I told her. "I'm planning on a club station and we won't want to be interfering."

"Nothing wrong with the PA," Leigh insisted, "except when you have that thing going."

Again, there was no use arguing. I changed the subject.

"What kind of slide show are you watching?"

"Presenting," she corrected me. The expression on her perfectly molded face was incredulous. "You really don't know?"

I shook my head.

"Teachers Association," she said tersely.

I decided her complexion wasn't perfect. She had two freckles on the end of her turned-up nose.

"Oh, the union thing."

Violet eyes blazed again. "Yes, the union thing. If you

want to see how underpaid and overworked you are, and how our educational system in this state compares with other states, why don't you come and watch?"

"Might as well," I grinned, "since you've put me off the air."

The Home Ec department was at the other end of the building. I had to walk faster than my usual ambling gait to keep up with her. I didn't tell her the reason I agreed to attend the meeting was because of her, not the union. I didn't have anything against unions. I knew they had done a lot of good, but I always had the idea they were for truck drivers, carpenters, and other trades, not for teachers.

"I'm surprised you're allowed to hold a union meeting in the school building," I made conversation.

"Mr. Higdon's on our side," Leigh replied, "even though he can't say so. He just conveniently looks the other direction."

Higdon was the principal. As far as I could see, he always looked the other direction when anything came up. Especially anything that required spending any money, like parts I needed, or books, or test equipment.

I sat through the slide presentation and listened to Leigh Wainright's perfectly modulated voice cite reams of facts and figures. A lot of what she said made sense. It was ridiculous that the lowest paid sanitation worker had take-home pay greater than a beginning teacher.

But I confess I was more interested in the curve of Leigh Wainright's slender throat, silhouetted by the projector light, than by the cause she espoused.

Finally the presentation was over. Bright lights flashed on.

"Well," Leigh Wainright concluded, "are we willing to do whatever we have to, to see these injustices are corrected?"

A chorus of "yeahs," "Yesses," and "You tell 'em, Leigh," rang out.

A man I recognized as a science teacher jumped to his feet. "Strike," he yelled. "I say, let's strike."

"Not so fast," Leigh shot back. "A strike is the last resort."

They wrangled for several minutes. There was no doubt about the sentiment. 90% of the teachers were 100% activists.

It was also very apparent that Leigh Wainright was Miss Big in the Teachers Union.

Slowly the room cleared. I lingered until only Leigh, I, and two burly men were left.

"Mr. Cook, I want you to meet Mr. Summers and Mr. Cannon," Leigh introduced them.

"Jake Summers," the older of the two stuck out his hand. He was fat and bald. "Pleased to meetchu."

"Likewise," Cannon said. He would have been handsome, in a swarthy kind of way, if it had not been for a white ragged scar across his left cheek.

"These gentlemen are from headquarters," Leigh explained.

Both were impeccably dressed, but I though they could have passed as fugitives from a chain gang. But the union men were of little interest to me.

I was tuned to resonance on Leigh Wainright's wavelength. I screwed up my courage. Nothing ventured, nothing gained, I told myself.

"Miss Wainright – Leigh," I finally stammered. "Could I – that is – do you need a lift home?"

"I have my car."

I knew she did. My heart's S-meter dropped to zero.

"But if you want to follow, we could stop for a Coke," she added.

Did I want to? You bet your sweet one and only 4CX1000 I wanted to!

A short time later, facing Leigh across a table, I listened for the second time to her union sales pitch. "And we *will* strike if we have to," she concluded.

"What about the kids?" I objected. "Is a strike fair to them?"

"As fair as what the city fathers are doing to us – and to them."

I still didn't agree, but I was willing to discuss it all night, just for the privilege of sitting and watching the sparkle in her violet eyes, and the bounce of her blond hair. Finally the subject of the union was exhausted. We really began to get acquainted. Before we parted I had a date for the next evening.

The following morning I had the attention of the entire class, at least for a few minutes, when I fired up the rig. I caught a "4" in Florida who was willing to rag chew. I explained what we were doing and even let some of the students say a few words, after explaining this was permissible, as I was actually operating the equipment.

The students seemed to be fascinated as much by the VOX as by the QSO itself.

"Well?" I queried, after I signed and turned down the receiver gain.

"That was really somethin'," one of the two girls in my class exclaimed. "'Specially the way your voice turns everything on and off."

"Yeah," Russell Allen, a boy who had been even more of a problem student than others, interjected. "But how you make any bread, man, outta just talkin'?"

"You don't make money," I explained. "In fact, it is against the law to use amateur radio for commercial purposes. But you can learn – how to build, adjust, and maintain radio transmitters and receivers. There are millions of jobs in related fields: police radio, taxicabs, broadcast, TV . . ."

I waxed eloquent, "Why, hams have always been pioneers, opening up frequencies once considered worthless."

I stopped, knowing he would not understand about frequencies. "I learned most of what I know working with ham radio," I finished. "I could hold down almost any kind of electronics job, and be making a lot of money."

Russ pounced on my words. His brown eyes danced and his chocolate face displayed an insolent grin. "Then how come you're here, teach?"

There was nothing stupid about Russ Allen. I desperately wanted to reach him, to help him, but I felt frustrated.

"Money isn't everything," I finally replied. "I'm here because I want to do something useful."

"If you ain't here for the bread, how come you gonna strike?"

So the strike talk had got back to the students.

"Nobody said I was."

"You gonna scab?"

I knew the conversation was going far beyond the area where it should have been allowed, but I had let it go too far to stop.

"I'll be here to teach any day the school is open," I told him. "Now, how about you? Are you going to take advantage of your opportunity for an education?"

"I be here," he said, "if you be."

That night my date with Leigh Wainright went as smooth as a local 2 meter QSO. For the first time in my life, I found myself more interested in a girl than my radio equipment.

It happened sooner or later to most good hams, I excused myself, judging by the number of XYLs and junior ops.

I went to a number of union meetings with Leigh, at various locations throughout the city. Each was a repeat of the one at Riverside, although the teachers at Riverside were by far the most militant. At each meeting the two organizers, Jake Summers and Art Cannon, were present. But I could not see that they took

any active part.

Once I tried to explain ham radio to Leigh. She echoed Russ Allen's thoughts.

"But Ken, what good is it?"

I repeated all I had said to Russ and added:

"Hams handle all kinds of emergency messages during floods, tornadoes, ice storms, and so forth. Many have emergency power. Countless lives have been saved and literally millions of messages have been handled for the Red Cross or branches of the military. The Army, Air Force, and Navy all recognize the value of hams and have their own ham organizations – The Military Affiliate Radio Service – MARS."

She may have been impressed, but she failed to show it. However, I knew she was uptight over the union thing.

"We have this local net right here in the city," I went on. "We meet every Friday night . . ."

"Meet? Where?" she interrupted. "Would they be interested in seeing my slides?"

I laughed. "We meet on the air for an emergency drill."

"Oh," she said, "just a bunch of radio nuts."

For the first time, I was angry with her. "Ham radio operators include some of the finest and best-known people in the world," I snapped. "People like Arthur Godfrey and Barry Goldwater. Doctors, lawyers, teachers, politicians, businessmen, policemen – you name it. I'm new in this city, but I'm willing to bet you'll find every profession I named on the net!"

"Sorry," she said, "I didn't mean to rile you."

"Would you like to listen when it's my night to call the net?"

She nodded, but without enthusiasm.

I continued seeing Leigh Wainright almost every evening. Thoughts of a home and family life were very much a part of each day.

Strike talk waxed hot. I helped Leigh draw up a list of demands. Truthfully, nothing asked was unreasonable, except perhaps the dues check-off – whether a teacher chose to belong to the union or not. And even that was a matter of opinion.

The list was duly submitted to the School Board and passed up to the Mayor and Commissioners.

In the meantime, I moved more of my personal equipment into my room at school. I set up my two and six meter FM rigs. Beams were not necessary because of the repeaters. Both rigs were VOX controlled. I had always been a nut about that, so I could keep both hands free to solder or wire while operating.

Finally, it seemed, I was at last creating some student interest. I didn't know if the ham demonstrations deserved the credit, or if I had, somehow, at least partially, won their trust.

In spite of dating, I still managed to meet the net. Leigh Wainright or no Leigh Wainright, I had no intention of abdicating this responsibility. On several occasions I found Russ waiting for me outside the school. He puttered in the shop, soldering on a code practice oscillator and listening as the net progressed.

Then negotiations began to break down between the teachers organization and the School Board.

Leigh Wainright was totally committed to teachers' rights.

I found out she had chosen a position at Riverside because she wanted to expose the conditions there, which were worse than they were in any other school in the city. I could see she was becoming more and more frustrated.

One afternoon she told me, "I'm sorry, Ken. I can't be with you tonight. We have a showdown meeting with the School Board. The way it looks now we'll be on strike tomorrow!"

I hadn't thought much about the possibility of a strike. I figured they would work something out. And if the worse came to worst, those who wanted to strike would stay home and those who didn't, wouldn't.

I seldom watched TV and nothing prepared me for the scene outside the school the next morning.

The crowd was immense. Students, parents, police, reporters, TV crews, and teachers milled about. The teachers moved in a circle, carrying placards which proclaimed their grievances. Leigh Wainright headed the marchers.

She saw me and waved a hand in greeting.

The din was intense. Parents shouted obscenities. Teachers replied. Students, looking forward to a holiday, agitated by throwing an occasional rock or bottle from time to time at the cordon of police who stood between them and the teachers.

"You goin' in, teach?" I heard a familiar voice inquire. The arrogant smirk I remembered was on Russ Allen's face.

I had not known until that minute what I would do.

I squared my shoulders. "I'm going in."

"Wait," Russ instructed.

He moved about swiftly and was back in a couple of minutes with three of my students.

"This is all," he said.

I led the way. We moved toward the cordon of police. Two stepped forward to meet us.

"I'm a teacher," I said. "I'm not striking. We're going in."

"We can't guarantee your safety!"

"We're going in," I repeated.

Their ranks parted slowly. We moved forward, up to the line of marching strikers. I met Leigh Wainright, face to face.

"Ken," she gasped.

"I'm going in," I told her. "The children's education is more important than anything else."

The look on her face told plainer than words how she felt.

Police parted the marchers. We slipped through onto the school grounds. I noted a couple of other teachers and a dozen students followed us.

Then I spied Summers and Cannon. They stepped from the line and moved quickly alongside of me, one on each side.

"Friend," Jake said, "ain't you makin' a slight mistake?"

Cannon seized my arm. His hand was like a vise. "Breakin' a picket line could be downright unhealthy, friend."

"Besides, what will your little woman think?" Jake added.

I shook them off and trudged ahead. Now I knew the function of the two: muscle men, when the going got rough.

The day was a washout as far as any actual work on lessons was concerned. But I sensed a new respect from Russ Allen and the other three students. Once he put his thoughts in words:

"You really ain't here just for the bread, teach!"

"I need money to live same as anyone else," I replied. "But educating America's future citizens seems more important to me than the size of the salary."

He nodded, solemnly.

That afternoon, getting out of school was as much an ordeal as getting in. The police surrounded us completely and escorted us through the crowds.

The next day we knew what to expect, and took our lunch. Six teachers and maybe fifty students crossed the picket lines with us. And the day following, more than 100 students and several additional teachers.

The contempt in Leigh Wainright's eyes was almost more than I could bear. But there was nothing I could do.

She thought she was right. I felt I was.

That afternoon things appeared even more hectic. Boos were plentiful and obscene gestures the order of the day as our little band, encircled by police, started across no man's land, away from the school.

Then shouts and yells arose. Several people surrounded a police car and began rocking it. More swarmed around and the car was turned onto its side.

Our escort rushed toward that mob, and the striking teachers headed for me. I felt a blow in my stomach, and caught a glimpse of Cannon as I went down. Then feet were tromping. I realized the people had gone mad as blackness closed around me.

When I awoke, it took seconds to realize who I was, minutes before the wail of a siren and the motion of a vehicle penetrated my mind. I was flat on my back on a stretcher.

Then I thought it had to be a dream as part of that dream spoke:

"Ken. Thank God, Ken. Are you all right?"

"I am now," I told Leigh Wainright. "That is, if I'm even here." Then memory hit me. "The kids? Other people? How many were hurt?"

She shook visibly. "Too many. Maybe I've been wrong, Ken. I never knew people could go crazy."

"Not people," I said. "Mobs."

"When I saw you – all hurt like that . . .," she choked. I reached for her hand.

At the hospital they checked me over, patched me up and checked me in. I had cuts and bruises, and a lump on the head, but no broken bones. But they insisted I remain overnight for observation.

Leigh stayed until they ran her off.

"See you in the morning at school," I told her.

"Ken, no," she remonstrated. "Haven't you had enough?"

I shook my head.

She kissed me before she went out the door. Once again I slept with visions of a blond, violet-eyed XYL and six junior ops running through my dreams.

They released me early the next morning. I went directly to the school. The scene was much subdued from the day before. It was as if the mob had run out of steam after blowing a pop valve.

A few teachers still marched. Leigh Wainright was not one of them. I looked about for familiar faces and was relieved to see the bushy Afro and intelligent brown eyes of Russ Allen. He wore a bandage on one cheek and one arm was in a sling.

"Ready, teach?"

"Ready," I said.

The students bunched behind me as we walked toward the picket line. No words were spoken as we crossed the street. As we approached the picket line, I heard Leigh cry out from behind me:

"Ken! Wait!"

She joined us and I reached for her hand.

"I-I'm still for the teachers," she said, "but I can't be a part of violence."

"You wanted to call attention to conditions here at Riverside," I told her. "And I guess you've done that."

"The wrong kind of publicity," she said bitterly. "People who saw those news films on TV will think teachers are a bunch of wild animals."

That morning, almost a third of the teachers and student body entered the building. It was my guess the strike was all but over. And little, or nothing, had been accomplished.

But one good thing had come out of it. I had gained the respect of my students. Russ Allen was the prime example. He listened to every word I spoke, and I knew he was convinced I was sincere in the work I was doing.

Leigh spent most of the day observing my class, since none of her students were present. She was impressed at the eagerness Russ and the other students displayed.

That morning and again in the afternoon, I fired up the rig and we talked to people in six different states.

"Tonight's my night to call the 2 meter net," I told Leigh. "Want to sit in?"

"Here?"

I nodded.

"Can we get in the building?"

I shrugged. "Why not? I get in every day, and the picket line is only during school hours."

"I'd love to," she agreed.

That night I picked Leigh up early and we drove slowly to the school. There was no indication a strike was in progress. But as we parked, a police car cruised by, circled, and came back. We identified ourselves. In a couple of minutes Russ joined us and we proceeded into the building.

A school security guard intercepted us at the door, but he knew us and we exchanged greetings as I reset the lock.

"Better keep everything locked," he advised. "We ain't takin' no chances."

"I think the strike's about over," I replied.

"Me, too," he agreed. "And I'm plenty glad. My old lady's scared to death I'll get hurt or somethin'."

"I was, too," I confided. "And then I was."

We laughed together. I invited him to join us for a while when he made his rounds.

The door to my room, after the usual sequence, opened. I snapped on the light and fired up the 2 meter rig. It was not quite net time, and the usual pre-net chitchat was in progress.

I explained the VOX system to Leigh, and told her how autopatch worked.

Russ made the necessary entries in my log book. I opened the net and began roll call. I was about a third of the way down the list when my door rattled violently.

"Wait one," I said into the mike. Habit caused me to rotate the receiver gain to "0" before I went to the door. I lifted and pulled, expecting to see the security guard.

"Well, ain't this a party?" Jake Summers snarled as the door swung open.

He pushed past me. Cannon followed. The younger man's hand closed in a vise-like grip around my arm. "Friend, didn't we tell you crossing a picket line could be unhealthy?"

"Jake! Art! What is the meaning of this?" Leigh demanded.

Both men laughed. "Now, sister. You didn't think we could let you welsh on our deal, did you?" Jake sneered.

"You'd better leave," I tried to make my voice firm. "The security man will be here in a few minutes."

"He ain't likely to be nowhere for a long time, friend."

Out of the corner of an eye I saw Russ move toward the transmitter. I thought I knew what he was trying to do. I began struggling. I had to keep the thugs' eyes off the boy.

Cannon's hand found my throat, and Jake landed a kick in my groin. But I had seen Russ's hand turn up the mike gain before he glided away.

"What we gonna do about the boy?" Jake demanded.

I heard a faint click as I doubled over. The VOX relay had kicked in. I prayed they hadn't noticed.

"We got no choice," Cannon snapped. "We ain't gonna leave no witness."

Russ's eyes were wide and round. "I don't hear nothin'," he said. "I don't see nothin'. I don't say nothin'!"

"W-What do you intend to do – with us?" Leigh asked.

They didn't answer.

"Listen," I shouted, before the delay unlatched. "You can't break into River-

side Vo-Tech and kidnap us — maybe murder us — and get away with it. People know where we are. They'll be here in a hurry. Jake Summers, you tried to kill me yesterday. You didn't make it. You won't get away with it today!"

"Shut up," Jake growled.

"Come on," Cannon snarled. "Let's get out of here."

He hauled out a snub-nosed revolver from beneath his coat and waved toward the door.

"You, too," he told Russ.

"Please, Mister. Don't make me go. I ain't gonna say nothin'."

Again, Cannon waved the pistol toward the door. Russ dropped to the floor and began yelling.

"Help, somebody, please! They gonna kill us. They gonna take us away and kill us, right now!"

Russ was the picture of a genuinely terrified boy, and I couldn't blame him, for I wasn't exactly comfortable about the situation. But he knew he was "on the air," and no actor ever gave a better performance.

Jake landed a solid kick in the boy's side. Russ quieted as suddenly as he had begun. He staggered to his feet and lurched out the door.

Cannon twisted my arm behind my back and forced me forward into the hall. Jake prodded Leigh, who was sobbing softly.

I knew how terrified she was and I longed to comfort her. But there was no way I could let her know we had been telling more than fifty ham radio operators what was happening.

We moved down the hall, not toward the front of the building, but in the direction of the Home Ec department.

"Look," I said. "You need Miss Wainright. She hasn't quit the union. Let her go. She just came in this morning to watch me operate my ham rig."

"Shut up, punk," Cannon growled.

We reached Leigh's room. Jake opened the door with a key he took from his pocket.

Leigh hung her head. "I let them have my keyring one night to come after a projector. They must have had duplicates made."

So they had simply unlocked a door and walked in, I thought. I remembered the security guard, and how he had met us at the door. Then what Cannon had said.

They herded us across the room toward a window. Jake raised it, listened, shoved a big foot against the rotting screen, then climbed through.

"All right, sister," Cannon ordered.

Russ was next and I followed him.

The grounds were dark. We moved slowly, past the cafeteria, in the direction of the football field.

Had I miscalculated? Had the net members decided the real life drama relayed by our two meter repeater was a hoax?

I couldn't believe it, yet where were the police?

Then I heard something. Cannon heard it too.

"What was that?" He stopped.

"Garbage pail," I said. "Probably a dog."

After a long moment we moved forward again.

All at once I heard a welcome sound. The whoop-whoop and wail of a siren. Faint, but building. Then it sounded as if half the police force was approaching.

Two things happened almost at the same time. Cannon and Jake turned to run. I stuck a foot in front of the fat man, and he tumbled to the ground. Several figures popped up from behind the garbage cans.

"Stop or I'll shoot," one yelled.

Cannon swung toward the man, the revolver in his hand. A slim figure hurtled past me and into the thug's side.

Russ knew how to tackle.

Flashlights came on and a policeman got handcuffs on the two muscle men. Then the officer turned to me.

"Hi, Ken," he said. "I'm WA9——. I was just coming off duty and caught the excitement on my mobile rig."

"Boy, am I ever glad to see you," I said, and added, "this is Leigh Wainright. Leigh, this is Bob, one of the net members. You didn't realize it, but the VOX circuit kept my transmitter on all the time we were in my classroom.

Others crowded around, introducing themselves. Police began arriving by the dozen. Bob explained he had used the autopatch in his car to call them while en route.

Somebody said they had found the security guard, trussed up, and with a lump on his head, but otherwise OK.

The police took Summers and Cannon away, after telling us to report to police headquarters and give our statements the next morning.

By that time there were at least a couple of dozen hams milling about.

"What say we go to the radio room for an eyeball?" I suggested.

Everybody agreed.

Leigh Wainright had recovered her poise completely. She detoured through the Home Ec department and picked up a coffee pot. Soon, one would have thought we were at the end, or the beginning, of a big hamfest.

Hams kept coming until the room was overflowing.

Somebody fired up my rig and soon the word was passed to the shut-ins and distant net members.

Of course I had to go over what had happened several times, including Russ's cool and shrewd thinking.

One thing led to another. I began to tell them what I had accomplished with the students by using ham radio. Then Leigh took over and was soon conducting a tour of Riverside, pointing out all the glaring deficiencies.

I noticed one of the hams taking notes, and I remembered the boast I had made to Leigh about finding people from all walks of life on our two meter net.

When we got back to my classroom I conducted a poll. We had one newspaper reporter, seven doctors, one man who was an aide in the Mayor's office, four druggists, two plumbers, three policemen, fourteen people connected with radio and TV stations (mostly engineers), five lawyers, four teachers (two college level), forty-one who were businessmen or worked at various other positions, and, believe it or not, one *School Board member!*

"Just a bunch of radio nuts," I whispered to Leigh. "Do you think you could ever learn to love one?"

"Oh, Ken" was her only comment. But the look on her face gave me the answer I wanted. That was three years ago.

We now have one junior op and another on the way. Leigh got her ham ticket a year after we were married.

I wish I could say the ham School Board member and the ham newsman gave us enough publicity that all ills at Riverside Vo-Tech were cured.

But it didn't work that way.

True, we got good publicity, and the support of the media. Some improvements were made, and we got a small raise in pay.

As usual, everything in life was a compromise.

One interesting thing came to light.

Jake Summers and Art Cannon both had felony records, and were not official representatives of the National Teacher's Organization. They were part of a wildcat, militant union and had lied to Leigh, intending to use the union as a base of operation to further some nefarious scheme.

Russ Allen graduated from Riverside with honors, and most of my classes are now there to learn.

I give ham radio the credit. Wouldn't you? ■

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Bob Wilder W4NVH
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CB to 10 - -

A Legal Alternative

- - part 1: bandplan and crystal info

For some time now, there has been an ever-growing concern over the outcome of the ten meter band. The ham use of the band has dropped over the past several years due to sunspot activity to a point where other services, mainly Citizens Band, feel that the frequencies could be put to better use. I remember when I used to work into Europe daily with five Watts and a dipole on CW and AM, and even into ZL and VK land after I got up a 3 element "plumber's delight" beam.

The sunspot cycle, though probably not as good as the one back in the late 1940's, is about to open the band up again. Many groups are presently getting ready for better activity on ten with the establishment of nets and even new repeaters.

The above is the whole idea behind this article: an easy way to get back on 10 meters with low power with a small outlay of cash.

When the FCC announced that they were increasing the Citizens Band from 23 channels to the current 40 channels effective January 1, 1977, the prices started to drop on the 23 channel units. If indications here apply to the country as a whole, a lot of hams started picking up these cheap rigs with the idea of first going on CB in their cars to keep track of traffic, and secondly, someday converting the CB rig for use on other bands, namely 10 meters.

Also, there seems to be a large influx of former CBers giving up the ranks of CB and going on to amateur radio. Over 80% of the new hams in the Mobile, Alabama, area are former CBers who wanted to get away from the QRM on 11 meters. Most of these former CBers still have their old CB rigs stored away in their junk boxes. They have picked up the ham habit of never throwing away anything that might be usable some time in the far distant future. Now is the time to drag out that old 11 meter rig and convert it to 10 meters on crystal controlled channels that could become standard all over the country.

The first thing that has to be done to make the whole idea of getting low power transceivers to work is to establish some simple ground rules. If every person converting a CB rig for 10 meters picks frequencies at random, very little activity will result. I would like to therefore suggest some standard blocks of channels (frequencies) that could be used to increase the effectiveness of these low powered rigs. With both the Novice and Technician class license holders on 10 meter CW, it can be seen that there

		Converted Ten Meter Frequencies		
Channel	Original Frequency (MHz)	Novice/Tech Frequency (MHz)	AM Phone Frequency (MHz)	SSB Phone Frequency (MHz)
1	26.965	28.005*	28.705	28.505
2	26.975	28.015*	28.715	28.515
3	26.985	28.025*	28.725	28.525
4	27.005	28.045*	28.745	28.545
5	27.015	28.055*	28.755	28.555
6	27.025	28.065*	28.765	28.565
7	27.035	28.075*	28.775	28.575
8	27.055	28.095*	28.795	28.595
9	27.065	28.105	28.805	28.605
10	27.075	28.115	28.815	28.615
11	27.085	28.125	28.825	28.625
12	27.105	28.145	28.845	28.645
13	27.115	28.155	28.855	28.655
14	27.125	28.165	28.865	28.665
15	27.135	28.175	28.875	28.675
16	27.155	28.195	28.895	28.695
17	27.165	28.205*	28.905	28.705**
18	27.175	28.215*	28.915	28.715**
19	27.185	28.225*	28.925	28.725**
20	27.205	28.245*	28.945	28.745**
21	27.215	28.255*	28.955	28.755**
22	27.225	28.265*	28.965	28.765**
23	27.255	28.295*	28.995	28.795**

*Fig. 1. NOTES: * = Channels 1 through 10 and channels 17 through 23 in the CW segment are not authorized at this time for Novice or Technician class use. ** = Channels 17 through 23 in the SSB segment are the same frequencies as channels 1 through 6 and channel 8 of the AM segment.*

28.505 MHz Output Used To Show Example of Crystal Frequency

Transmit Crystal Frequency	Transceive Crystal Frequency (Both Transmit and Receive)	
F 28.505 MHz	F - 5010	23.495 MHz
$\frac{F}{2}$ 14.25250 MHz	F + 5010	33.515 MHz
$\frac{F}{3}$ 9.5016667 MHz	F - 10000	18.505 MHz
$\frac{F}{4}$ 7.126250 MHz	F + 5995	34.500 MHz
	F + 6200	34.705 MHz
	F + 10635	39.140 MHz
	$\frac{F - 3456}{2}$	12.52450 MHz
	$\frac{F + 8750}{3}$	12.41833 MHz
	$\frac{F - 10700}{3}$	5.935 MHz

Receive Crystal Frequency

F - 265	28.240 MHz	F - 455	28.050 MHz
F + 455	28.960 MHz	F - 1365	27.140 MHz
F + 1650	30.155 MHz	F - 1650	26.855 MHz
F + 1680	30.185 MHz	F - 1750	26.755 MHz
F - 1755	26.750 MHz	F - 2310	26.195 MHz
F - 3580	24.925 MHz	F + 4000	32.505 MHz
F + 4300	32.805 MHz	F + 4224	32.730 MHz
F - 4455	24.050 MHz	F - 5500	23.005 MHz
F + 6000	34.505 MHz	F - 6000	22.505 MHz
F - 6500	22.005 MHz	F + 6685	35.190 MHz
F + 7500	36.005 MHz	F + 8000	36.505 MHz
F - 10000	18.505 MHz	F + 10700	39.205 MHz
F - 20635	7.870 MHz	F - 23505	5.000 MHz
31955 - F	3.450 MHz	$\frac{F - 455}{2}$	14.025 MHz
$\frac{F + 455}{2}$	14.480 MHz	$\frac{F - 455}{3}$	9.350 MHz
$\frac{F - 455}{4}$	7.0125 MHz	$\frac{F + 1650}{2}$	15.0775 MHz
$\frac{F + 1640}{3}$	10.048333 MHz		

Fig. 2. NOTE: With this many different i-f combinations being used, it is necessary that exact specifications of the transceiver to be converted are known.

must be a block of channels that they can use when they convert a CB rig to CW operation. There is unwritten use of SSB only on the low frequency end of the 10 meter phone band, so the SSB CB rigs that are converted should have a block and, of course, the bulk of the converted CB rigs, being inexpensive AM rigs, will need their channel allocations. Fig. 1 lists all three of the groups of 23 channels that could be used.

The very nature of the basic CB transceiver makes this type unit one of the simplest to convert to ten meter operation. In the case of other types of low power surplus equipment that has been available in the past, the tunable stages have been fairly narrow, but in the case of the CB rig, the tuned stages are fairly broad. To fulfill the requirement of being channel selectable without being tunable by the operator, most CB rigs on the market today will give close to 4 Watts output at both extremes of frequency, that is, at channel 1 and channel 23.

After reviewing the crystal requirements of over 1200 different CB transceivers, I was able to arrive at the common configuration for both transmit and receive crystals. Every transceiver reviewed fell into one of the configurations shown in Fig. 2, where "F" indicates the output frequency desired.

The frequency combinations shown in Fig. 2 are for CB transceivers that use a single crystal for each transmit channel and another crystal for each received frequency. This type of transceiver can be modified for use on 10 meters, but the expense would probably be more than buying or building a simple 10 meter transmitter and simple converter for use with an existing receiver. The possibility of building a simple VFO to replace the crystals in the transmitter and receiver sections of this type of transceiver would solve the problem of the large numbers of crystals needed.

There are two other

PART II

ORIGINAL CRYSTAL FREQUENCIES FOR CB OPERATION

Crystal	Crystal Frequency (MHz)	Channel Numbers
A	23.290	1-2-3-4
	23.340	5-6-7-8
	23.390	9-10-11-12
	23.440	13-14-15-16
	23.490	17-18-19-20
	23.540	21-22-23
B	37.600	1-4
	37.650	5-8
	37.700	9-12
	37.750	13-16
	37.800	17-20
	37.850	21-23
C	11.705	1-4
	11.755	5-8
	11.805	9-12
	11.855	13-16
	11.905	17-20
	11.955	21-23
D	8.159	1-4
	8.209	5-8
	8.259	9-12
	8.309	13-16
	8.359	17-20
	8.409	21-23
E	11.740	1-4
	11.790	5-8
	11.840	9-12
	11.890	13-16
	11.940	17-20
	11.990	21-23
F	14.950	See Note 1
	14.960	See Note 2
	14.970	See Note 3
	14.990	See Note 4
G	10.595	See Note 4
	10.615	See Note 3
	10.625	See Note 2
	10.635	See Note 1
H (LSB)	7.4585	See Note 1
	7.4685	See Note 2
	7.4785	See Note 3
	7.4985	See Note 4
I (USB)	7.4615	See Note 1
	7.4715	See Note 2
	7.4815	See Note 3
	7.5015	See Note 4
J	11.0035	See Note 1
	11.0135	See Note 2
	11.0235	See Note 3
	11.0435	See Note 4
K	7.4225	See Note 1
	7.4325	See Note 2
	7.4425	See Note 3
	7.4625	See Note 4
L	11.275	Transmit (TX)
	11.730	Receive (RX)
M	10.140	See Note 4
	10.160	See Note 3
	10.170	See Note 2
	10.180	See Note 1
N	7.8015	LSB
	7.7985	AM and USB
	7.3435	RX Oscillator
O	7.8025	All Frequencies

PART I

Manufacturer	Model Numbers		See Part III for Crystal Formula Shift	TX/RX	Main OSC
B & K (Cobra)	19, 21 & 29		L	F	A
B & K (Cobra)	130, 131 & 132	LSB	N	H	C
		USB	N	I	C
B & K (Cobra)	138 & 139		O	J	D
B & K (Cobra)	132A & 132B	LSB	N	H	C
		USB	N	I	C
Pace	123A		M	G	B
Pace (SSB)	1000B, 1000M		O	K	E
Pace	CB-143, CB-144		M	G	B
Midland	13-880B, 13-885	LSB	N	H	C
		USB	N	I	C
Midland	13-895		O	J	D
Realistic	TRC-23B, TRC-40, TRC-49		M	G	B
Robyn	T-123B		L	F	A
Robyn	T-123C, K-123 AMGT-VII		M	G	B
Royce	I-602		M	G	B

PART III

CONVERSION FACTORS FOR 10 METER OPERATION

From Part I Key Letter Sequence		Lowest Frequency for Channel 1 (see Fig. 1) 28.005 MHz	28.505 MHz	28.705 MHz
L F A		L=10.235 MHz TX L=10.690 MHz RX (Frequency groups A & F remain the same) TX = 38240 - Freq. of low end. RX = 38240 - Freq. of low end + 455 kHz	L=9.735 MHz TX L=10.190 MHz RX	L=9.535 MHz TX L=9.990 MHz RX
N H C	LSB	H=8498.5 kHz (Frequency groups N & C remain the same) H = Low end frequency minus 19506.5 kHz	H=899.5 kHz	H=9198.5 kHz
N I C	USB/AM	I=8501.5 kHz (Frequency groups N & C remain the same) O = Low end frequency minus 19162.5 kHz	I=9001.5 kHz	I=9201.5 kHz
M G B		B=38640 kHz (Frequency groups M & G remain the same) + 1040 kHz The above is the frequency "B" must be raised for each frequency group for operation in the 10 meter band.	O=39140 kHz + 1540 kHz	B=39340 kHz + 1740 kHz
O K E		O=8842.5 kHz (Frequency groups K & E remain the same) O = Low end frequency minus 19162.5 kHz	O=9342.5 kHz	O=9542.5 kHz

Fig. 3. NOTES: 1 = Channels 1, 5, 9, 13, 17, and 21. 2 = Channels 2, 6, 10, 14, 18, and 22. 3 = Channels 3, 7, 11, 15, and 19. 4 = Channels 4, 8, 12, 16, 20, and 23.

groups of transceivers available on the market at the present that could be modified. First of these is the synthesized units which use combinations of a small number of crystals to obtain all of the transmit and receive frequencies desired. The second class of transceiver available is the phase locked loop or PLL type that uses very few crystals and digital frequency generation to obtain the frequencies needed.

The combinations used for the synthesized units are almost without limit. When converting a transceiver of this type, it would be of necessity to obtain a complete schematic and parts list for the unit from the manufacturer or one of the CB service type books on the market listing your transceiver. Though the synthesized type is cheaper to modify than the type using crystals for each frequency, there could be problems in obtaining the necessary information to determine the crystals needed.

In Fig. 3, I have listed several of the more common synthesized units available and crystal data necessary to convert the units to 10 meters. Fig. 3 is divided into 3 parts for ease of understanding.

The crystal combinations listed in Fig. 3 are examples of some that will be encountered when trying to shift an eleven meter CB transceiver to the 10 meter band. I have found that the simplest way to calculate the frequencies needed is to use only channel 1 to determine a simple formula. Once a formula is obtained, each crystal frequency can be found. The best way to select which oscillator you want to shift is to select the one that requires the least number of crystals to make up the greatest number of frequencies.

The Cobra 138, Cobra 139, Midland 13-895, Pace 1000B, or the Pace 1000M should prove fine choices for conversion to 10 meter SSB. In each of these, the original 7.8025 MHz crystal is the only crystal that needs to be changed. It seems logical that a multiple deck crystal switch/socket package could be used. This arrangement would allow several 23 channel arrangements over the 10 meter SSB segment. For example: Selection of the lower end frequencies of 28503 kHz, 28505 kHz, 28507 kHz, and 28510 kHz would require only 4 crystals for a total of 92 channels between 28503 kHz and 28800 kHz.

There are several linear amplifiers on the market today which are smaller than most CB transceivers and have output of 50 to 100 Watts. Of course, most of these units are rated as 3 to 30 MHz "ham" amplifiers which actually only work well between 26 and 30 MHz. These small amplifiers could be used to increase the mobile or fixed capability of the converted transceiver.

The final type of CB transceiver that can be modified for 10 meters is the PLL type. These are more expensive than the other two types for several reasons. The PLL is the easiest to modify by the CBer for operation on frequencies other than the 23 or 40 channels for which the unit was built. This type of unit is the easiest for the manufacturer to convert to 40 channel operation. This ease is, of course, the major reason that this type of transceiver lends itself to modification to the 10 meter ham band.

I have selected 8 different models of PLL transceivers that are available to show what can be done to modify this type of transceiver for 10 meter use. Fig. 4 lists the PLL transceivers and the crystals that are presently used for generation of the necessary signals for 11 meter CB operation.

By referring to the original frequencies of the CB trans-

Manufacturer	Model	Crystal Frequency	Oscillator Use
Pace	CB-166	10.240 MHz	All Frequencies – Reference
Teaberry	Stalker One	44.73 MHz	AM OSC – RX
		13.1325 MHz	SSB OSC – RX
		7.8025 MHz	USB Carrier OSC
		7.7975 MHz	LSB Carrier OSC
		10.00 MHz	REF OSC
Teaberry	Stalker Two	Same as the Stalker One	
Standard	Horizon 29	10.24 MHz	REF OSC
		5.575 MHz	Transmit
SBE	SBE-26CB	10.240 MHz	All Frequencies – Reference
Palomar	Digicom 100	12.803 MHz	USB REF OSC
		12.800 MHz	AM/LSB REF OSC
		10.7 MHz	AM/LSB Carrier OSC
		10.697 MHz	LSB Carrier OSC
Royce	I-601	10.24 MHz	REF OSC
		10.695 MHz	10 MHz OSC
		36.38 MHz	37 MHz OSC
Realistic	TRC-57	13.1325 MHz	13 MHz OSC
		44.73 MHz	AM RX OSC
		7.8025 MHz	LSB OSC
		7.7975 MHz	USB OSC
		10.000 MHz	PLL REF OSC

Fig. 4.

ceivers as listed in Fig. 1, various shifts in oscillator frequencies can be obtained. The intent of this article is not to give a step-by-step conversion of CB transceivers to 10 meters, but instead only to tell what can be done with the available units on the market.

In the case of the PLL transceiver, it will become a matter of experimentation to determine the exact frequencies needed. I recommend that anyone attempting to convert a PLL transceiver become very familiar with PLL circuits in general. In the type of transceiver requiring only crystal changes to change the output frequency, the processes are simple. In the case of the PLL circuit, the problems that can be encountered in digital development of the frequencies needed are best solved by the more expert in the ham ranks. The conversion of a PLL transceiver is not a project that should be tackled by the new ham or one with little or no knowledge of solid state devices.

There are several things that must be taken into account before you attempt conversion of any CB transceiver for operation on the 10 meter band. Mainly these can be grouped into a few simple questions:

1. How much do I want to spend if I have to buy a new or used CB transceiver?
2. Does the CB transceiver I presently have lend itself to easy and cheap conversion?
3. How much electronics knowledge do I have to solve the problems I will encounter?
4. Do I feel that 10 meters is worth all the effort to convert a CB rig to that band?

If all of these questions can be answered in such a way to indicate that your next project is to be the conversion of a CB transceiver for 10 meters, then get started before the band starts to open up for some rare DX. ■

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Save Your Old Speakers

- - how to remove the beehive

In the old days, service technicians did a lot of speaker cone recentering to clear up annoying rattles, which was at the time a tedious but possible job.

Current speakers generally make speakers throw-away, due to their modern design, so they're "go or no go" devices. There is, however, a possible cure if the rattle is due to an off-center voice coil and it's a fast repair.

Remove the speaker. Hold it close to your ear and gently, with fingertips, alternately press and release the cone about an inch from the rim toward the voice coil and listen for scratchy sound. Rotate the speaker while doing this. If the speaker is capable of this fast cure, you will find the noise limited to one point on the circumference. Carefully note that point. Lay speaker on a solid flat surface, with magnet up. Then use a heavy rubber mallet to strike the magnet end a sharp blow or two at a point directly opposite to point where the scratch was heard. Don't get over-ambitious with pounding. A few lighter raps are far better than one hefty wallop. In effect, you are recentering a misaligned voice coil. Result is usually a clear-up of the rattle. ■

Beware the Compressor!

- - some pitfalls to avoid

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Killeen TX 76541

Speech compressors really work! Using one on 10 meters with a friend about 8 miles away, I found that the average level nearly equaled the average level obtained when switching on and off a 1200 Watt amplifier. The objection is that a) The background noise may be excessive unless some care is exercised in adjustment; b) Enough distortion is introduced from the compressor that it may even be objectionable or unpleasant to delicate or sensitive ears (again, careful adjustment may be the answer); and c) The problem of congestion on the bands is not addressed with a compressor, in fact, it is sometimes made worse by signals being too wide – again an adjustment problem, usually.

The third reason given above is probably the best known by amateurs in general. There is also a small amount of interference noticed by some, that of detecting a portion of the unwanted sideband when using an SSB station. The problem here is usually at the transmitter, but the point is that it exists!

Another form of interference to the SSB operator is that of another station moving into about 2 kHz of your frequency, which is referred to as "Alligator Teeth." Not only is it distracting, you sometimes find yourself attempting to copy both the station you are in contact with and the adjacent station.

Herein I will outline an idea and a concept which the reader and experimenter should be aware of and, perhaps in the not too distant future, the concept will be put into action by some of the more adventurous and innovative amateurs. I will be using it myself, but I believe that when the concept is understood, not only will it be used by amateurs, but also by the military and by commercial communications systems.

In order to understand the idea of band compression, some background preparation is in order. No doubt there are some readers with insight and experience who could proceed at once to the block diagrams and read the conclusion. Others could probably say they thought about something similar in the past and may have surpassed me in the initial design. This is encouraged. In fact, I hope and expect to see specific diagrams and schematics in the future that will enable anyone to duplicate the circuitry.

Unless the reader has had some experience with linguistics, foreign language, or has had extensive English study, the vital parts of communication must now be covered.

In the English language, as well as many others, the S and Z sounds (voiced and unvoiced hissing sounds) contribute the most to the *understandability* of verbal communications. These sounds lie in the frequency range above 1 kHz, and below 1 kHz are the explosive sounds such as B, T, D, M, N, L, K, G, F, and P. There exist languages in the world that are made up of the explosive sounds alone, and the frequencies above about 1 kHz are not vital to verbal communications. Granted, the upper frequencies are necessary for providing depth and naturalness to the human voice, but as far as communications are concerned, we can get along without the upper frequencies. However, we must have some way of signaling to our ears when the high frequencies (the S and Z sounds) are part of the verbal communication.

Moving right along, a glance at Fig. 1 will now give the reader a preliminary understanding of the band compression concept. Following the signal from the antenna through the receiver, a frequency splitter using active filters will pass the frequencies from 300-1000 Hz, but will attenuate the frequencies above and below. However, the frequencies *above* 1 kHz (with a cutoff of about 2.5 kHz) will signal or gate a white noise generator. This white noise will be adjustable for naturalness and will signify the S and Z sounds by a hissing sound.

The combination of the white noise generator's output and the 300-1000 Hz frequencies are made in the mixer where the strength or relationship of the two signals is effected. The audio amplifier rounds out the receiver system.

By this time, the idea should be firming up. The transmitter block diagram is shown in Fig. 2 and is nothing but the reverse of the receiver's signal processing.

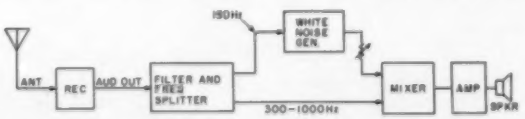


Fig. 1. Receiving block diagram.

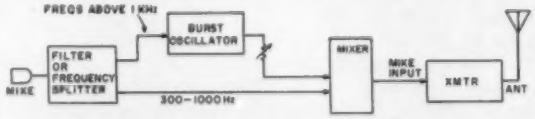
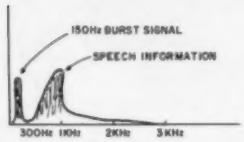


Fig. 2. Transmitter block diagram.

Fig. 3. Rough spectrum representation.

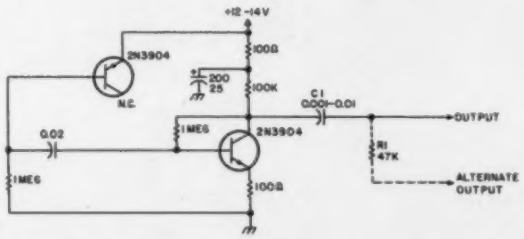


The frequency splitter passes those frequencies between 300 and 1000 Hz and senses those frequencies above 1 kHz (with a cutoff at about 2.5 kHz). The signal sensing frequencies above 1 kHz trigger or gate a burst oscillator which I've arbitrarily chosen to be set at 150 Hz. The mixer then combines the two frequencies and the microphone input will have a signal roughly conceived and shown in Fig. 3, with a 150 Hz triggering signal and those frequencies between 300 and 1000 Hz being transmitted.

Now, before you say this will give an effective bandwidth of 1 kHz, it must be noted that due to combining the two signals and the inherent mixing processes, the total effective bandwidth is closer to 1 kHz plus 150 Hz, or approximately 1.2 kHz, to be safe, could be considered the overall bandwidth. It should be understood that we would not be using pulse modulation, since those frequencies above 1 kHz have been merely attenuated and could be recovered by amplification of the upper frequencies. Also, since the usage of S and Z sounds is so entirely random in natural conversation, band compression would not detract excessively from the usually less than ideal conditions on the bands using single sideband.

My reason for not being specific with schematics, printed circuit board layouts, parts list, etc., is that not only am I plowed under with projects, but I also believe that there are many fertile minds in amateur radio that not only could conceive the project, but also could breadboard and build it. I have included a white noise generator circuit which is known to work; however, the gating and level setting circuitry will have to be designed. All experimentation could even be done by using two tape recorders, but it must be remembered that this will not be high fidelity. If high fidelity is desired, go to 2 meters (where, coincidentally, I've noticed some use of speech compressors, much to the detriment of the inherent quality of voice communications).

Fig. 4. Noise generator circuit. Note: Values of output components will be selected during breadboarding (C1 and R1).



Conclusion

In the history of radio communications, there have been repeated cycles of refinement and improvement. First, we had spark or "noise generators," which were replaced by vacuum tube oscillators and tuned circuits, making them cover a smaller frequency spectrum. Then came voice communications. Amplitude modulation was, and still is to some extent, a good means of communication. With congestion beginning to build up, other means of communication were sought, however, and with wire communication pioneering, double and single sideband transmission were studied as an alternative. The state of the art was refined as oscillators became more stable, materials became available, and construction methods were standardized. The military demand for the best available communications equipment produced unequaled models for others to follow, when considering the period in which they were designed.

The world of communications is again at a turning point. Amateurs are able to "make do" by using maximum usable frequency techniques and by selective listening, but this only serves to refine one's operating. With the congestion apparent at the lower frequencies, an approach allowing less adjacent frequency interference and therefore more effective usage of the amateur bands would seem to be very desirable.

We as amateur radio operators are concerned with "getting the message through." By using band compression, we would not be bothered by adjacent channel interference. However, in the future, another problem will surely consume us if we do not move with the times, and this is super-saturation. More compactness in our frequency bands will be necessary and this is why I use the term "band compression." The challenge is before us and amateurs could find themselves the pioneers once again.

I would like to express my thanks to Ken Frank WB5AKI for his understanding and encouragement in the band compression project. We have intentions of building and testing the concept and may later be able to provide more data, schematics, etc. You would then see them in *73 Magazine*, unless some other fellow amateur beats us to it! ■

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Matching Output Transformers

When installing multi-tapped output transformers, it is often confusing to try to follow charts and, in some cases, an incorrect match is made due to not knowing voice coil impedance. To avoid this, and obtain a perfect match, connect one terminal of the transformer to one side of the voice coil. Connect an output meter across the voice coil. Introduce a 400 cycle audio signal to the detector with enough attenuation to show a low reading on output meter with probe on any lug. Then, with a probe clipped to open side of voice coil, touch each lug on secondary of transformer in turn with the probe, noting change in meter reading.

The combination of lugs giving highest reading is the nearest match and will give maximum efficiency. This can be done with any multi-tapped audio transformer and applies to either primary or secondary. ■

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RD #1
Hopewell PA 16650

Stop Timeouts!

-- build this 10 minute ID timer

I would like to say, at the outset, that there is nothing new or original about this timer. All the bits and pieces were stolen from various magazines and books. However, I must modestly admit I designed what I wanted and made it work.

Of all the timers I have ever built before, none really ever satisfied me. I have built the tube type and the solid state type using the RC timing method, but their accuracy leaves something to be desired and they are difficult to adjust to the ten minute time period.

Being LED readout happy, I decided to build a ten minute readout timer that would read out the minutes, recycle after ten minutes, shut off the alarm after two or three seconds, and could be manually reset at any time. This is a lazy man's timer that can be built for less than a thousand dollars.

The problems in building the counter were numerous, because I am a raw beginner and do not pretend to know what goes on inside those little black boxes. Previous to this project, I marked the fronts of all my magazines with IC circuits that interested me, along with the page numbers (e.g., all 555 timer circuits and 4700 bounceless switch circuits, etc.). Then I armed myself with about twenty dollars worth of books, of which the *TTL Cookbook* proved to have the most information in terms that I could almost understand.

I sent away for the ICs and sockets from the ads in the backs of the magazines and bought the balance of the goodies at our local Radio Shack. I had some junk on hand and used that where possible. The Radio Shack salesman asked me what I was building. After I gave him all the glowing details, he said, "How about one of these mechanical timers for $3.50?" I already had about ten bucks worth of stuff between my thumb and forefinger, and thought to myself, "I wouldn't want this character working for me." He said "It's all solid state." Then I knew he was pulling my leg. I told him no self-respecting ham would use a mechanical timer – it isn't sophisticated enough for the state of the art. This sophistication does cost more, but I decided to go first class.

I built the enclosure out of 3/8" thick walnut and copied the metal cabinet design of those cute miniboxes with the slanted overhang in the front. If you decide to build your enclosure, the vectorboard used for the ICs and wiring was 4-1/2" wide by 5-7/8" long, and the 4 spacers or legs under the board were 1/2" high. I kept these spacers as short as possible to keep my nosy friends from getting a good view of the sloppy wiring job. The bottom of the enclosure is 4-5/8" wide by 6-1/2" long, the ends are 4-5/8" wide by 3-3/8" high, the top is 4-5/8" wide by 7-7/8" long, and the sides are 3-11/16" high by 7-7/8" long. I sanded the walnut lumber first with #80 grit paper, followed with #120 grit, and finished with #220 grit. I glued the ends onto the bottom section (using no nails) and kept it in the vise for 24 hours to dry. The sides are glued to the top section in the same manner. After this section dried, I cut the front at an angle to give that overhang effect. The finish on the cabinet is hand-rubbed like the finest furniture.

I used Radio Shack's .1" vectorboard for construction, keeping all components above the board and the rat's nest below. I ran reset, ground, and positive bare buses of solid #20 copper wire as near the ICs as possible, and threaded them up and down through the holes to hold them firmly in place. The readout was fastened to a small piece of vectorboard about 1-1/2" square using an IC socket and fastening all 1/4 Watt resistors on the same board. All wires that leave the board were the stranded type, for flexibility. This makes it easier to fit the readout to the hole in the panel and to hook up the speaker and controls. I left these wires objec-

tionably long so I could assemble them out of the cabinet and get the circuit board in and out of the cabinet without a fight. At this time I must admit there was an architectural mistake in the design of the cabinet. The front is too thick to accept the tone control and the push-button switch. I had anticipated this and made the front 1/4" thick, but I still had to chisel out enough wood to make them reach.

The speaker is mounted on the rear of the cabinet with three thumbtacks. It is an 8 Ohm 2" Radio Shack speaker. The voltage regulator is mounted on the left side of the rear cabinet. The heat sink is a piece of 1/8" scrap aluminum with mounting holes drilled to match the mounting holes in the regulator. There was a mechanical engineering problem here, however. The regulator is slightly dome-shaped, and the point of the dome just touched the aluminum when the regulator was drawn down tight with sheet metal screws. I healed this problem by folding some aluminum foil into a thick pad, placing it in between, and drawing it down tight.

The power supply is simple and easy to build. The despiker capacitors are perhaps the most important items in the project. I believe all the problems that I describe later could have been avoided if I had included them in the first failure. The diodes are from my junk box – the bullet type. The voltage regulator is an M390K, but any 5 volt 1 Amp job could be used. The filter capacitor could be increased to 3000 uF as the power supply voltage is at the bare minimum.

The 60 Hertz line frequency is divided by IC1 and IC2 to give a one second pulse. This is connected to the decimal point on the readout through a 220 Ohm 1/4 Watt resistor, and pulses every second to give an indication that the timer is working. This one second

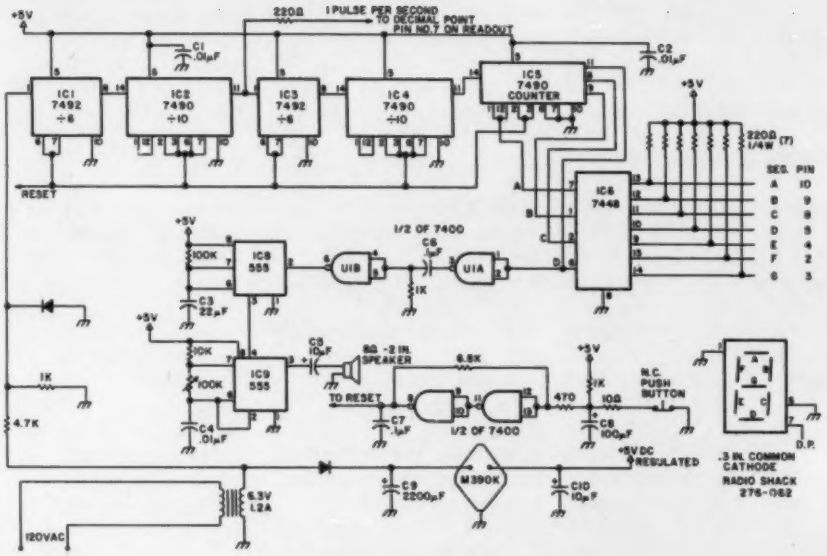

Fig. 1. Ten minute ID timer.

pulse is then divided by IC3 and IC4 to give a one minute pulse or, to be more exact, to give a pulse every minute. The one minute pulses are then counted by IC5, and its binary output is fed into IC6, which drives the seven segment readout. I used a 7448 driver and a common cathode readout because I had them on hand. Most circuits use a 7447 driver with a common anode readout, and use series resistors to limit the current in the segments. I tried my readout without any resistors by hooking it up direct, but it wasn't bright enough. I experimented with various pull up resistors, starting at 500 Ohms and working my way down until I was satisfied with the brightness. I settled for 220 Ohms, as I had a lot of them on hand (the segments were drawing 15 mA current with a maximum rating of 25 mA). This is a very nice, clear, bright readout, and not very expensive.

IC7 is a 555 timer wired in the monostable mode with RC values to give a 2.2 second output on pin 3, which is used to drive the alarm circuit. I arrived at these values from the chart that came with the 555 timer. The first try gave me exactly what I wanted. I discovered, when breadboarding this circuit, that it would trigger when I pushed my mike button or flicked the switch on my desk lamp. I learned by reading my various books that the input pin 2 must be held high until the negative pulse arrives to trigger the timer. What a problem! I also needed a negative pulse every ten minutes to trigger the timer. The 7490 goes low at the end of the ten minute period and stays low until the count of eight. What a problem! At this point I needed help and found it by way of ham radio.

Another ham, Jack Sponeybarger (a retired electrical engineer), gave me the idea for the quick pulse and suggested the values that worked on the first try. This circuit uses two gates of the 7400 IC and works as follows: The 1k resistor holds pins 4 and 5 of U1B low, which in turn holds pin 6 of U1B high and keeps the triggering pin 2 of the timer high. At this time, the inputs of U1A pins 1 and 2 are either high or low, depending where the count is at any particular time. If they are low, then pin 3 of U1A is high. When pins 1 and 2 go high at the beginning of the count of eight, pin 3 goes low but nothing happens across the capacitor C6, because the other side of the capacitor is held low by the 1k resistor. Please don't get lost yet, for the real action is about to take place. When the 7490 counter reaches the end of the count of ten, its "D" output, pin 11, goes low, pins 1 and 2 of U1A go low, and pin 3 goes high, causing a brief positive spike across C6.

Now for the thrilling part of the action. This positive spike causes pins 4 and 5 of U1B to go high and pin 6 to go low, thus triggering the 555 delay timer. The only time the 555 is triggered is on the negative going edge of the output from the 7490 counter. I was quite proud of this circuit, thinking it was very original, but I later on found several versions in the *TTL Cookbook* disguised as negative or positive edge triggering circuits. There are other ways of doing this; I tried most of them, but decided to let well enough alone.

The alarm circuit is another 555 timer and is a triggerable astable multivibrator. This was stolen directly from a recent *73 Magazine* article describing a keying monitor circuit. It is almost the same, except that I

eliminated the volume control that was located ahead of the speaker and changed a few values here and there to match my junk box. The 100k pot is the tone control, which varies the tone from an ear-piercing high to an annoying growl. This is a beauty, and is the only one I have ever built from a 555 that worked properly.

Manually resetting the timer to zero was my biggest problem. This takes a bit of doing, especially when using a cheap, normally closed push-button switch. I tried every bounceless switch circuit I could find, but nothing worked 100%. Every time I went to show off my timer, I had to push the reset button a half dozen times to get it set to zero. I would get a count of one, and sometimes as high as an eight. Everything else worked nicely.

The ten minute cycle worked fine, and the alarm sounded for 2.2 seconds. The timer proceeded merrily on its way with the decimal point blinking every second as planned, but she would not reset worth a hoot. They make bounceless switches for a price, but I was determined to make this one work. Finally, I tried a circuit I copied from the *TTL Cookbook*. It consists of the other two gates of the 7400 IC and the associated goodies. This was better, but not perfect, until I added C7 to pin 8 of U1D, which gave me one failure in about ten tries.

I took the little jewel to work to show it off, and Murphy's Law set in. After a short time, the damn thing began to beep every second. I told the fellows I had designed it that way. I brought it home and started to tune up my rig. The alarm went off and it began to count like crazy. After all that work I had the only timer in the world that couldn't be used in a ham shack. My ham buddies were very helpful, making some good and some wise guy suggestions. One fellow said I shouldn't have used a wooden cabinet, so I wrapped the little dud up tight in aluminum foil – but that didn't help. It did tell me, however, that the rf was coming through the line cord. All the while, I was thinking that I could have painted my window sills this summer instead of fiddling with this thing. I was about to hide the thing in the midst of all my other failures and unfinished projects when I decided to try it in another outlet. When I unplugged it, I noticed my line cord was about 4" from my coax on the rig. When I plugged it into another outlet, it worked fine, even when I sat it on top of the rig, right over the finals.

When I reflect back on the last problem, I believe I was thinking like an engineer instead of a technician.

I still was not satisfied with the reset circuit. It was at this point in time that I added the .01 uF capacitors that I mentioned earlier. That was without a doubt the source of all my troubles. We have a computer-controlled milling machine at work, and I noticed that every IC on the circuit boards had a .01 uF from the positive input pin to ground. They were located as close as practical to the IC. I can now plug it into the outlet behind my rig, set it on top over the finals, take it to work where they have loads of line noise, and the little beauty works perfectly. I can now reset it 100 times out of 100 tries.

This miracle of modern digital electronic engineering has been running 24 hours a day since last July, counting and indicating the minutes, blinking the seconds and sounding the alarm every ten minutes. I never unplug it, except to take it somewhere to show it off. My XYL was annoyed a little for the first month or so, but then I would change the tone to another pitch to break the monotony. I guess she finally decided that as long as that thing buzzes, the OM is not working on it. ■

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Have You Tried Television?

- - it's easier than you think

Ralph B. Mott WB4KTY
1816 Marion Ave.
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The interest in ATV is due, at least in part, to the availability of reliable 470 MHz commercial surplus gear at very reasonable prices. *73 Magazine* has had RCA transmitter strips advertised for fifteen dollars from DuPage FM, and Gregory has had GE equipment, both transmitter and receiver strips, for twelve to thirty dollars. With the advent of small compact solid state modulators (Tom O'Hara's W6ORG modulator), it has become both simple and cheap to put your ham station on ATV.

Most ATVers are members of a club, even if it only has five or six members, or they work together in groups of two or three. It ain't much fun sending a picture if nobody sees it!

Since conversions of the RCA CMU-15, GE Progress Line, and Motorola T44 have been pretty well covered elsewhere, this part of the job is no longer considered to be in the realm of mumbo-jumbo and we need not go into any detail on conversions as such. Generally, the conversion consists of building a power supply, lengthening the grid lines on the RCA, or just retuning the GE to the correct frequency. The Motorola with its 2C39s is a little different, but it still puts a potent signal on the air. We completed the first rough conversion on our new RCA CMU-15 in four evenings and a Saturday.

Neither do we plan to go into the receiver conversion. The receiver can be as complicated or as simple as you wish. We know of five guys locally who are on ATV. Four of us use RCA CMU-15s and one uses the GE Progress Line. All of us used the same general conversion information for the transmitter strips, but no two of us are going the same route on our receiver conversions. Just use your imagination. Rather than get into the particulars, we are going into customizing your gear after you have it working and putting out an acceptable picture.

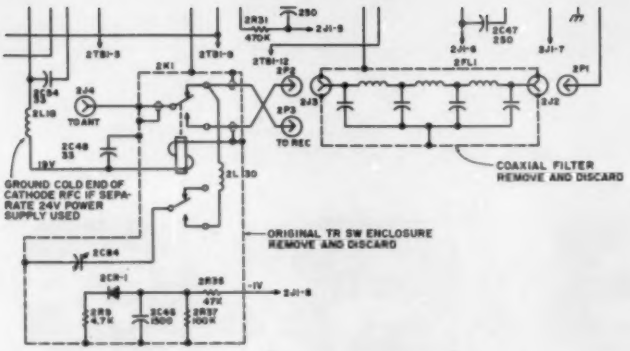
GROUND COLD END OF CATHODE RFC IF SEPARATE 24V POWER SUPPLY USED
ORIGINAL TR SW ENCLOSURE REMOVE AND DISCARD
COAXIAL FILTER REMOVE AND DISCARD
TO ANT
TO REC

Fig. 1. Partial schematic.

Customizing your gear allows you to take a mass-produced item and convert it to your own uses. This allows your own personality quirks to come through. This thing of personalizing your equipment has become a big thing with the American male. Note the number of automobile speed and customizing shops, even such things as firearms with customized grips, cases, and holsters, or do-it-yourself home remodeling, built-ins, and add-a-room projects. These are all fair game for the avid do-it-yourselfer, so why not your ATV rig?

There are not many appliance operators among the ranks of the ATV fraternity. Until recently, there was just no commercially made ATV available, so anyone on ATV had to be a home brewer. In getting my ATV station on the air, I had a lot of fun and learned a good deal about UHF as well. We now have really effective PTT type operation, and this makes for a lot of fun and satisfaction.

My ATV station is not the quick and easy type. We had been active on ATV for some time when we got tired of throwing two or three switches and waiting for the video to come on, so we decided to make further refinements. We had removed the coaxial filter between the antenna PI tuning section and the antenna switching relay. In this unit the antenna switching relay coil is in the cathode circuit of the 5894 second tripler-driver stage. There is 19 volts available at this point, used to control the TR relay. When excitation and B+ is applied, the second tripler-driver conducts, causing the relay to switch the antenna. The B+ is applied through a relay on the power supply strip on the original chassis. We had considered using the original TR switch; however, when we removed the coaxial filter to

broaden out the bandpass, we were left with about fourteen inches of open space to fill between the output PI section and the TR switch. The TR switch was located on the front of the chassis. After some thoughtful moments, we decided to leave the short four inch piece of coax undisturbed due to the way it was attached to the antenna matching assembly enclosure. Also, this area is rather crowded, and all space saving ideas must be utilized, including mounting the modulator circuit board on the underside of the chassis. Since the original TR switch must be shielded if it is to be used, there just was not enough room for all that had to fit there.

We found that an old TR switch out of a junked ARC-3 would work as well as the original. Mounting it directly on the rear panel within three inches of the PI network output allowed us to solder directly to the cable which was already there. We completely removed and discarded the original TR switch along with the components in the box with the relay. This included the 1N48 diode and the 48k and 100k resistors, which we soon discovered was where the rf came from which was available at pin 8 on the 11 pin metering socket on the top of the chassis. We now use an rf loop coupled directly to the antenna coax line for an rf indicator. This works very well and gives a true indication of the rf power level if properly calibrated. It can also be used to check swr by reversing the leads in the line.

If the ARC-3 arrangement does not appeal to you and you have a 24 volt transformer and relay knocking around the shack, it would work just as well to build up a small power supply for the TR switch. We made everything in the rig straight PTT and mounted our 24 volt relay directly on the chassis of the power supply. We prefer 24 volt control circuitry to 110 volt control for obvious reasons. Holding 110 volts in your hand on a PTT button does not seem to be the best way to go. For those brave souls using 110 volt control, the extra trouble of the 24 volt supply can be eliminated.

Using 19 volts available at the relay end of the RFC in the cathode line saves running another line from the power supply to the transmitter chassis. If it is desired to use an external 24 volt source to operate the TR switch, the cold end of the RFC in the cathode circuit must be grounded, because the coil of the original TR relay was part of the cathode resistance in the 5894.

To mount the new ARC-3 TR switch, drill two 5/8" holes on 2½" centers, remove the RCA plug from the end of the coax cable, and solder the coax directly to the input of the new TR switch. Then retune and you are in business.

One word of caution: When we were originally converting our CMU-15, we had some circuitry underneath the rf cage bottom plate. After a while, a short developed which completely killed the signal. The rig would work with the bottom of the rf cage removed, but not when it was in place. We found that one of the screws holding the bottom plate in place extended through the plate far enough to short one of the grid lines. When we removed the screw and plugged the hole, we had no more trouble.

The small size and potent 15 Watt signal make the CMU-15 a natural for mobile or portable operation, making possible good on-site displays at hamfests and meetings. As soon as the power supply has been completed, we are looking forward to an ATV session with an aircraft mobile. Should be fun! ■

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Quick Vertical

- - for 20 and 40

Verticals have always performed well on the long haul DX contacts that many hams enjoy participating in. The vertical radiates power at a very low angle, enhancing the possibility of a DX contact. The dipole radiates power at a much higher angle.

The antenna I am going to describe was designed for simplicity. It is simple to erect, taking a matter of an hour or so, and will not make a dent in your wallet!

The radiating portion of the antenna is made of #18 wire. Many other sizes may also be used. Cut the wire to a length of 28 feet. The wire may then be held up in a number of ways. A well-used scheme has been to run the wire up a wooden pole.

Once the wire is held up vertically, you can proceed to hook up the feedline. The feedline used is *ordinary speaker wire*, commonly sold at Radio Shack stores. It just so happens that the speaker wire has an impedance of approximately 45 Ohms, and works beautifully as a balanced feeder. Hook up one side of the line to the base (the wire) of the vertical, and the other wire to a ground rod, at least 5 feet long. It is also advisable to have 4 or more ground radials each 33 feet in length connected to the ground rod.

After the feedline has been brought into the shack, it will have to be trimmed to a length that will reflect the least amount of current, as the antenna does not resonate exactly on the 20 and 40 meter bands. A bit of juggling with the length of the antenna feedline will give you a respectable match. If you start by tuning the antenna up on the 40 meter band, the 20 meter band will also have a low swr with the same length of feedline.

This antenna works well on both 20 and 40 meters, with an swr of 1.3:1 on both bands. The antenna is quite broadbanded; it is possible to operate both CW and SSB on both bands. After putting up this antenna, the first station I worked was a Russian. Although this antenna works well as a regular home-QTH antenna, it is especially suited for portable operation and use, due to its ease of construction and erection. ■

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Try Power Saver Logic

- - a guide to CMOS applications

Appearing for the first time commercially in 1968, complementary metal oxide silicon (CMOS) logic elements have been steadily advancing and are presently competing strongly with other logic families. These devices are monolithic integrated circuits containing P-channel and N-channel enhancement type MOS field effect transistors. The MOSFETs exhibit high input impedance (requiring very low input driving currents) and can operate over a wide range of supply voltages (3 to 15 volts). Also, the complementary arrangement of the two output transistors prevents both from being turned on simultaneously. As a result, there is no direct path for dc current flow and consequently power drain is very low.

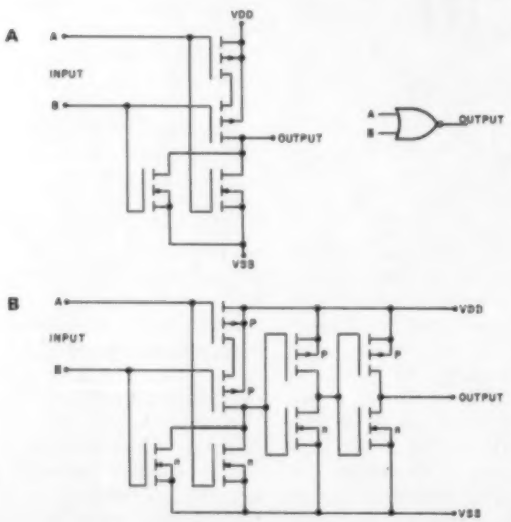

Fig. 1. Diagram showing (a) a conventional 2-input NOR gate and (b) a fully buffered 2-input NOR gate.

CMOS devices also exhibit an almost ideal logic transfer characteristic, meaning that they have exceptionally high noise immunity. As an example, CMOS logic elements have a guaranteed noise margin of about 1.5 volts, while other logic elements (such as TTL) have noise margins of only 0.4 volts.

These main features – the low power consumption, operation over a wide range of supply voltages, and high noise immunity – make CMOS logic easy to work with. However, like other logic families, certain design rules must be followed if successful results are to be obtained. In many cases, the design rules are different from past practices with TTL logic, and these differences will be discussed in greater detail in subsequent sections.

The technology is also improving as more and more manufacturers compete to produce smaller, lower priced chips containing more complex circuits. There is presently a large assortment of medium and large scale integrated circuits to choose from in building communication systems, instruments, and computer interfaces, including microprocessor applications. In addition, you may choose from standard non-buffered logic, or the "B" series of fully buffered gates. Fig. 1 contains a typical diagram of both a conventional NOR gate and a fully buffered NOR gate. The input gate protection circuits, not shown in this figure, will be discussed later.

While there are some differences among the various manufacturers concerning specifications, there are certain definitions that all generally agree on. These basic parameters along with their symbols and definitions are shown in Fig. 2. In working with CMOS circuits, you should become familiar with the various parameters contained in this chart to avoid exceeding the power limitations of the devices and also as an aid in debugging new systems.

CMOS CHARACTERISTICS AND FEATURES

The CMOS family is unique in that it contains many of the same functions found in TTL, while also providing special functions not available in any other logic family. The following is a partial listing of some of the functions available:

1. NOR gates (2, 3, 4, and 8 input)
2. AND gates (2, 3, and 4 input)
3. OR gates (2, 3, and 4 input)
4. NAND gates (2, 3, 4, and 8 input)
5. Inverters and Buffers
6. Complex gates

(exclusive OR, NOR, etc.)
7. Flip-flops (R-S, D, J-K, Tri-State)
8. Counters (BCD, Binary, Decade, Up/Down)
9. Registers
10. Decoders/Demultiplexers
11. Decoder/Drivers
12. Analog Switches

The analog switches are unique and have no TTL equivalent. In addition, there are hex contact bounce eliminators (MC14490), watch/clock circuits (MC14440), oscillator/dividers (MC14450), and tone encoders such as the MC14410.

Comparison to TTL

In general, CMOS specifications are a bit loose when compared to the rigid parameters of TTL logic. Industrywide, there are variations between devices of different manufacturers, as well as variations between devices produced by the same supplier. However, being aware of these differences should be sufficient for you to overcome any problem areas that may arise. Also, it's important to realize that many parameters such as current, voltage, and ac characteristics are standard for all devices.

As mentioned previously, the primary advantages of CMOS over TTL include low power dissipation, low quiescent current, high noise immunity, high fan-out, and reliable operation over a wide range of supply voltages. These features are summarized in Fig. 3 and will be discussed in greater detail throughout this article.

Quiescent Current and Power Dissipation

In order to understand the low power operation of CMOS devices, let's review the circuit structure of a typical inverter stage. Fig. 4 shows a basic CMOS inverter including input protection circuitry.

In the quiescent state, one output transistor is off while the other is on. For this reason, the only direct path for dc current flow is leakage through the input protection diodes. This current flow is small and is on the order of 1 nanoamp.

Only when the device changes state does any significant current flow occur, and this is due mainly to the charging and discharging of internal and external capacitances. Once these capacitances are fully charged, current flow ceases again. Therefore, most of the power consumption occurs at short intervals during the transition of one logic state to another.

Power dissipation in CMOS devices is therefore directly proportional to the supply voltage, frequency, output load (capacitance), and one other factor — the rise time of the input signal. This relationship is summarized in Fig. 5.

To determine why capacitance plays such an important part in power drain, we must look to the input characteristics of the devices. Since the input stage of one device is usually the output load of the preceding device, the two are usually interrelated. The input of all CMOS gates may be represented as a resistor with a value of 10^{12} Ohms in parallel with a 5 pF capacitor. As CMOS devices are added in parallel, the total capacitance increases as the sum of the capacitances of the individual gates. For this reason,

PARAMETER	SYMBOL	DEFINITION
Input Current	I_{in}	The amount of current flowing into the device at a particular voltage on the input terminal and also a specified V_{DD}.
Input High Voltage	V_{IH}	The range of input voltages that represent high logic level.
Input Low Voltage	V_{IL}	The range of input voltages that represent a low logic level.
Minimum Input High Voltage	$V_{IH}(MIN)$	Minimum input high level allowed.
Maximum Input Low Level	$V_{IL}(MAX)$	The maximum low level input logic allowed.
Output High Current	I_{OH}	The amount of drive current flowing out of the device at a logic high level output voltage and V_{DD}.
Output Low Curre	I_{OL}	Drive current flowing into the device at a logic low level output voltage and V_{DD}.
Quiescent Power Supply Current	I_{DD}	Current flowing into the drain terminal.
Source Voltage	V_{SS}	Positive potential on the device.
Drain Voltage	V_{DD}	Negative or reference power supply (usually ground potential).
Output High Voltage	V_{OH}	Output voltage for a high level logic.
Output Low Voltage	V_{OL}	Output voltage for a low level logic.

Fig. 2. Parameters, symbols, and definitions for CMOS devices.

PARAMETER	STANDARD TTL	LOW POWER TTL	CMOS (5 Volt)	CMOS (10 Volt)
Quiescent Power (per gate)	10 mW	1 mW	5 nW	10 nW
Power Dissipation (per gate)	80 mW	18 mW	5 mW	20 mW
Noise Immunity	1 Volt	1 Volt	2 Volts	4 Volts
Toggle Frequency	35 MHz	3 MHz	5 MHz	10 MHz
Propagation Delay	10 nsec	33 nsec	60 nsec	25 nsec
Input Current	1.6 mA	0.18 mA	±10 pA	±10 pA
Fan-Out	10-STD TTL or 40-74L	10-74L	50*	50*
Input Impedance	5000 Ω	50,000 Ω	10^{12} Ohms	10^{12} Ohms
Output Impedance	100 Ω	10 Ω	400 Ω	200 Ω

*Depends on propagation delays.

Fig. 3. Comparison of standard TTL, low power TTL, and CMOS devices.

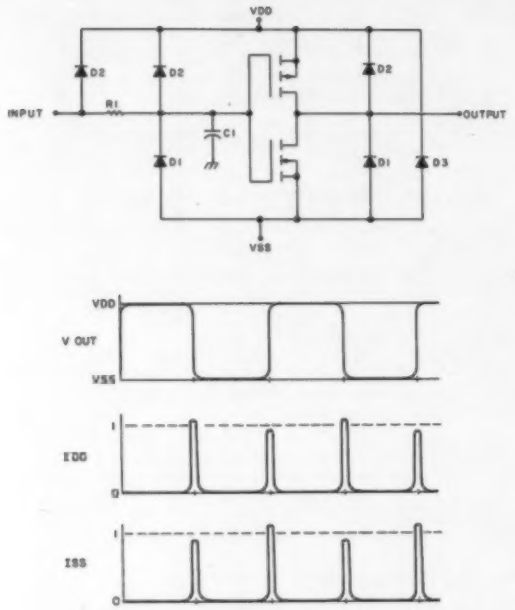

Fig. 4. Basic CMOS inverter with input protection. C1 – 5 pF; R1 – 200Ω; D1 – 25 V; D2 – 50 V; D3 – 25 V; Input: $t_r = t_f \cong 10$ μsec; Output: $C_L = 15$ pF.

the propagation delays and capacitance load (not the input driving load) are the factors that ultimately determine the fan-out limits of the device.

Input Current, Gate Protection, and Noise Immunity

As mentioned previously, the input impedance of CMOS devices is extremely high. Consequently, very little driving current is required for the device to change its state, or switch. Typically, the input current is ±10 pA. This low input current requirement is the reason that fan-out for the CMOS family approaches 50 (limited by the propagation delay), compared to TTL with a fan-out of only 10 gates. However, in most applications, the propagation delays will usually limit fan-out to 20 gates or less. There seems to be some discrepancy here, since many manufacturers specify propagation delays at 5 V or 10 V, 20 nsec transition, and a 15 pF load. The problem area is the 15 pF load, which seems to be standard among other logic families. For CMOS, it is somewhat unrealistic and a 50 pF load is closer to actual conditions. Most manufacturers are now beginning to specify propagation delays at output loads of 50 pF; this should help to clarify the situation.

Another CMOS characteristic that requires careful attention is its input impedance. While high input impedance is a distinct advantage in most circuit applications, it can also present problems wherever static electric charges are present. In an effort to protect the input gates, each manufacturer has incorporated some form of diode protection arrangement along with a series resistor to limit current flow. A typical example of this is shown in Fig. 6.

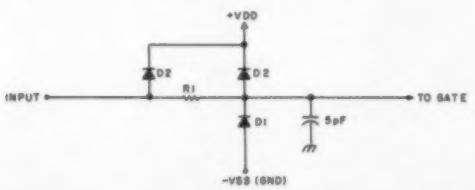

Fig. 6. Typical input gate protection circuit. R1 ≅ 200 to 2000Ω; D1 = 25 volt diode; D2 = 50 volt diode.

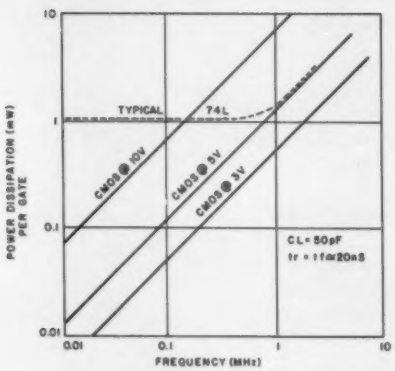

Fig. 5. Power dissipation as a function of the operating frequency.

However, extremely high voltages generated during very low humidity conditions will still damage the gates. Because of this, certain handling precautions should be observed which include:

Gounding of all test equipment, tools and soldering irons;

Storing CMOS devices in conductive foam or tubes (never in polystyrene foam); and

Never insert or remove devices with power applied.

Noise immunity is another parameter used to specify logic elements, and one form of noise is related to the speed of the device. Since TTL logic is faster than CMOS, the TTL device will transmit noise while the CMOS device rejects it. This is true for pulses of short duration as well as high frequency oscillations. This characteristic is often referred to as the "ac noise immunity," and it increases as the input pulse width becomes less than the propagation delay of the device.

Another consideration is "dc noise immunity." Due to the complementary action of the CMOS inverter (one transistor on while the other is off), the switching point is midway between the logical 1 and logical 0 states, or 45%-55% of the dc supply voltage. This results in a high dc noise immunity that increases with the supply voltage. This feature is illustrated in Fig. 7 for both buffered and unbuffered CMOS, as well as TTL characteristics.

A discussion of noise immunity would not be complete without mentioning external noise. The higher output impedances (10 to 100 times higher than TTL) exhibited by CMOS devices make them more susceptible to extraneous noise and cross-talk. Capacitively coupled noise immunity is one area where TTL is superior, although CMOS is hard to beat in terms of dc noise margin. Also, good printed circuit board layout practices will overcome any capacitive-coupled noise problems related to CMOS circuit design.

POWER SOURCE RULES

The overall costs of CMOS systems may be lower than equivalent TTL designs due to the lower power dissipation of CMOS devices and their ability to operate reliably over a wide range of supply voltages. Simple low

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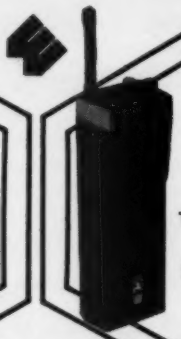

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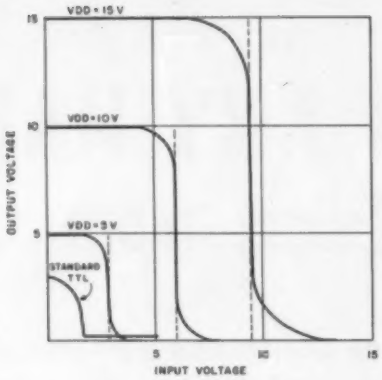


Fig. 7. Noise immunity increases with the power supply voltage as shown by these logic transfer curves.

cost power supplies with a minimum of regulation are all that is required to make the CMOS system operational.

From the comparison to TTL in the previous section, we learned that CMOS devices consume less power than standard TTL by a factor of 10^6. As an example of what this means, consider a system of 20 CMOS packages operated from a 5 volt power supply. At low frequencies, the total current drain from the power supply will be only 1.2 mA for all 20 devices! It is evident from this example that all portable battery-operated electronic systems should incorporate CMOS devices for low power consumption and long battery life.

Absolute Maximum Ratings

As with all electronic components, there are operating range limitations which, if exceeded, will destroy the devices. The maximum ratings are summarized in Fig. 8 for both the "A" series and "B" series devices. Maximum V_{DD} is +15 volts for the "A" and +18 volts for the "B" series. Maximum power dissipation is 200 mW and the maximum operating temperature for ceramic packages is +125° C and +85° C for plastic packages.

Typical Supply Voltages

All CMOS devices will operate reliably with V_{DD} in the range of +3 volts to +15 volts (with V_{SS} at ground potential). For this reason, CMOS is ideal in auto electrical systems, battery-operated instruments, and numerous other applications.

It is necessary to keep in mind, however, that the speed of operation is directly proportional to the supply voltage. Referring back to Fig. 3 in the previous section, at +5 volts, the maximum toggle frequency is 5 MHz, while at 10 volts, it increases to 10 MHz. Also, as the supply voltage increases, so does the power consumption. It is sometimes necessary to compromise between the desired operational frequency and the power consumption of the system at that frequency.

Power Supply Circuits

Almost any power supply will perform satisfactorily in a CMOS system because precise voltage regulation is not a primary consideration. However, it is necessary to keep the supply voltage within the 3 to 15 volt range and suppress any transients that may exceed the 15 volt range. An example of a typical power supply is shown in Fig. 9.

As mentioned previously, CMOS devices are ideal for operation from battery power supplies. Since the supply voltage is not critical, inexpensive dry cells may be used which exhibit large voltage drops as they reach the end of their useful life cycle. As an example of a standby battery system, Fig. 10 shows a rechargeable battery system added to the ac power supply just described.

There are a few power source rules that should be followed when working with CMOS systems. Careful observance of these rules will save you much time and frustration, not to mention reducing the failure rate of the CMOS devices.

Rule 1: Do not apply input signals to CMOS inputs without first supplying power to the V_{DD} and V_{SS} terminals of the device.

Rule 2: Always keep the operating supply voltage for V_{DD} within the 3 to 15 volt range (+18 volts for the "B" series).

Rule 3: Reversing the power supply polarity will permanently damage CMOS devices.

Rule 4: For operation of CMOS buffers from split voltage power supplies, V_{DD} should always be equal to or greater than V_{CC}.

Rule 5: For safe operation, limit the power source current to as low a value as practical for the system.

Rule 6: Transient turn-on of the input protection diodes may result from voltage drops across large resistors in series with V_{SS} or V_{DD}. Such resistors should be avoided wherever possible.

PARAMETER	SYMBOL	"A" SERIES	"B" SERIES
Maximum Supply Voltage	V_{DD} (+) V_{SS} (-)	-0.5 to +15 V dc	-0.5 to +18 V dc
Maximum Input Voltage	V_I	$V_{SS} \leq V_I \leq V_{DD}$	$V_{SS} \leq V_I \leq V_{DD}$
Power Dissipation (per package)	P_D	200 mW	200 mW
Maximum Temp. Range (PLASTIC)	T	-40°C to +85°C	-40°C to +85°C

Fig. 8. Absolute maximum ratings for CMOS devices.

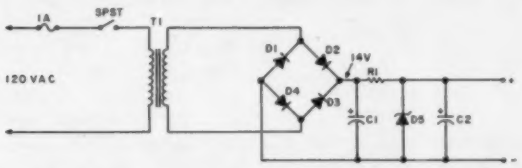
INPUT DESIGN RULES

Due to the high input impedance of CMOS devices, certain design rules should be followed to protect the gates. These rules, including TTL interface and handling considerations, are summarized as follows:

Rule 1: *Unused Inputs Must Be Connected to V_{SS} or V_{DD}*. If this rule is not followed, the device may generate faulty logic or exceed its rated power dissipation. Some manufacturers, in the case of plug-in type circuit boards, recommend that all inputs have some type of shunt resistor (200k to 1 megohm) to either V_{SS} or V_{DD}, whichever is appropriate for the specific logic circuit. This will serve to protect the IC when the board is not plugged into the main frame, or during storage when static charges may exceed the internal protective circuits.

Rule 2: *Input Signals Must Not Exceed the Power Supply Voltage Range of V_{SS} and V_{DD}*. Under certain conditions, however, the gate protection diodes will also conduct during normal operation and attempt to exceed the maximum input current of 10 mA. When these conditions exist, such as in oscillator applications, a series input resistor should be installed to limit the input current to a safe value. Typical series resistor values range from 10 kilohms to 100 kilohms without affecting the electrical characteristics, although the speed is reduced

Fig. 9. Ac power supply for CMOS systems (10 V dc @ 50 mA). C1, C2 – 100 uF @ 35 V dc; D1-D4 – 1N4001; D5 – 10 V zener @ 1.5 W; R1 – 82Ω, ½ W.



inversely with the increase in RC delay.

Rule 2 may be interpreted to mean that no input signals may be applied if the power supply is accidentally disconnected or turned off. However, if the proper series resistor is installed in the input circuit to limit the input current to 10 mA, the device will not be damaged under these conditions.

Also, for extremely hostile environments, you may want to consider installing external protective diodes to limit input voltage levels.

Rule 3: When a CMOS Device is Driven by a TTL Device, a Pull-Up Resistor is Required from the CMOS Input to +5 Volts for Open Collector TTL. The value of this pull-up resistor is usually a compromise between speed and power consumption. Typical values range between 1000 Ohms and 10 kilohms, with 2 kilohms providing the best trade-off between speed and power. Fig. 11 shows the relationship between the pull-up resistance and its effects on propagation delay.

Devices with internal pull-up resistors present no problem in driving CMOS devices as long as all devices are operated at +5 volts. In some cases, an external pull-up resistor may be required to insure reliable operation in the high state.

In the case of a CMOS device driving TTL logic, it's best to use a buffer such as the CD4049 or CD4050 operated with the 5 volt TTL power supply. These buffers are rated to drive two TTL loads at 5 volts. Also, unlike the CD4009 and CD4010 that require two power supplies, the 4049/4050 will operate satisfactorily from one power source.

OUTPUT DESIGN RULES

The output voltage levels for CMOS devices depend significantly on the level of V_{DD}. For example, for the CD4001A quad two-input NOR gate @ 25°C, the high level output voltage, V_{OH}, is 4.99 volts minimum for V_{DD} = 5 volts. When the supply voltage is 10 volts, V_{OH} = 9.99 volts minimum, and for all practical purposes, V_{OH} follows the value of the supply voltage.

The low level output voltage is typically zero or equal to V_{SS}. Compared to TTL logic, this is significant voltage swing, which accounts for the high noise immunity of CMOS devices. This V_{DD} to V_{SS} voltage swing is typical for all CMOS devices.

The output drive current (sink current) I_{OL} @ V_{OL} = 0.4 volts is dependent on the type device. For example, a plastic CD4001A will sink 0.3 mA and a CD4009A buffer will exhibit an I_{OL} = 3 mA. These are typical values with slight variations among the different manufacturers.

A few of the output rules and characteristics of CMOS devices are as follows:

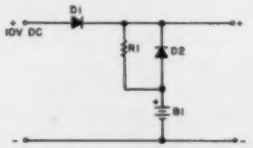
Rule 1: CMOS Devices Have a Typical Fan-Out Capability of 50. Since the input current I_I is typically 10 pA, it becomes obvious that CMOS devices with output drive currents of 0.3 mA (3 mA for buffers) are capable of driving many gates. However, due to the high input impedance (10^{12} Ohms), a CMOS driver sees the gate as a capacitor. As more gates are added in parallel, the propagation delays increase due to the increase in capacitance, and the next result is that speed is reduced as the fan-out increases. In this case, the limiting factor is not drive current, but capacitive reactance! Perhaps a more realistic fan-out would be in the neighborhood of 20 gates or less.

Rule 2: Do Not Short a CMOS Output to a Power Supply Bus Greater Than 5 Volts. CMOS devices are not short circuit protected and consequently, for shorts *above* 5 volts, the maximum power dissipation of the device will be exceeded. For operation at 5 volts or less, it is possible that the device may withstand an output short, although this may vary with the device.

Rule 3: CMOS, As With Open Collector TTL Logic, Cannot Be "OR" Wired. The reason for this design rule is to prevent an "ON" P-MOS and an "ON" N-MOS transistor from being shorted directly across the power supply terminals. One solution to this problem is to use tri-state logic wherever practical.

Rule 4: The Paralleling of Inputs and Outputs of Gates is Recommended Only When the Gates Are Within the Same Package. Due to the variations in specifications between the devices, in addition to the non-standardization of devices from the same manufacturer, problems may be avoided by paralleling of inputs and outputs only within the same package. The reason for this is to maintain a proper match and coordinate the various parameters involved.

Fig. 10. Standby battery system. R1 is chosen to limit the trickle charging current to the battery during ac operation. When the ac power fails, D2 conducts, while D1 blocks the battery current to the transformer supply, and the battery powers the system.



Rule 5: Output Loads Should Be Returned to a Voltage Source Within the Range of V_{DD} to V_{SS}. Here again, an attempt is made to limit the power dissipation of the device. Also, since output logic levels are directly related to V_{SS} and V_{DD}, returning the load to a voltage higher than the power supply may exceed the maximum voltage rating of the device.

Rule 6: Avoid Large Capacitances (5000 pF or Greater) on the Outputs of CMOS Buffers or High Cur-

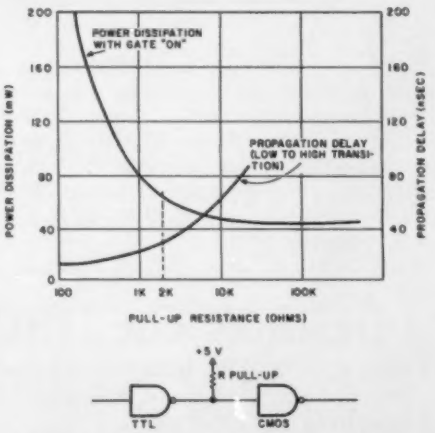


Fig. 11. Typical speed/power relationship for TTL interface with CMOS logic. The open collector TTL gate requires a pull-up resistor.

rent Drivers. Capacitances of this magnitude act as short circuits and may overheat the output transistors.

Rule 7: A CMOS Buffer Will Overheat If Used as a Linear Amplifier. CMOS devices draw maximum current during the transition of states. If these devices are made to operate linearly, current will be drawn for a longer period of time and the device will overheat. This is the reason that maximum clock rise and fall times (usually 5 to 15 secs) are specified for CMOS devices. Longer rise and fall times for devices operated over 5 volts will result in exceeding the maximum power dissipation of the device.

CONCLUSION

Each manufacturer of CMOS devices identifies his device with a distinct part number in which the basic function type can be picked out. For example, the following is a partial list of CMOS manufacturers and their own characteristic device number:

	Type Number
RCA	– CD ———
Motorola	– MC1———
National	– CD ———
Fairchild	– F ———
Harris	– HD ———
TI	– TP ———
Signetics	– ———
	(no prefix)

For RCA devices, the suffix letter immediately following the four digit function code usually indicates conventional ("A") or fully buffered ("B") configuration. The second suffix letter indicates the type of package, "E" for dual-in-line plastic, "F" for dual-in-line ceramic, and "K" for the flat pack ceramic. As an example, the CD4001AE is a quad 2-input NOR gate, unbuffered, in a dual-in-line plastic package. ■

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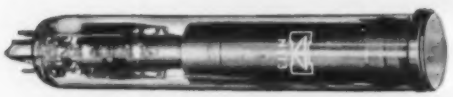

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73 Magazine Staff

HF Bands Expander!

-- eliminate splatter

to gain operating room

With many of the speech processing circuits in vogue these days, the SSB operator often operates his rig on the thin line between keeping it fully modulated and overmodulation with its attendant splatter. There are very few devices which can respond instantaneously to the changes in PEP as a transmitter is modulated and so inform the operator when a PEP value has been exceeded, which causes the transmitter to flat-top and splatter. Meters, no matter where they are located in the transmitter or antenna chain, are useless to identify transistory modulation peaks unless they are equipped with somewhat elaborate peak sensing and storage circuits. The only devices which by themselves can respond essentially instantly to voltage/current changes are electron tube display devices (scopes and magic-eye tubes), neon bulbs, and LEDs.

An oscilloscope is, of course, one of the best monitoring devices one can use. But, a scope can be expensive to employ as just a monitoring device, and it is not always easy to hook up a regular bench type scope for modulation monitoring. Also, it is hardly a handy monitoring device for portable operation. This article explores the use of simple and inexpensive neon bulbs and LEDs for the instantaneous indication of different PEP output levels.

The idea of using neon bulbs as an inexpensive PEP output indicator is certainly not new. It was done by many amateurs in the early 1960's, but it often proved to be a problem to get reliable indications on various bands unless the bulb circuitry was located at some point in the transmitter output line where the impedance remained the same on various bands. Today, this is not so much of a problem, since almost all amateurs use coax and also use a transmatch or similar device along with an swr meter between their transmitter and the antenna transmission line. The coax from the transmitter to transmatch is "flat" on every band, and that is the point at which to locate the PEP indicator.

W6GWS came up years ago with the circuit shown in Fig. 1(a). It is simply two neon bulbs connected in series with the voltage dropping resistors arranged so one bulb lights at a chosen *normal* modulation level and the other bulb lights when a *chosen PEP limit* is reached. The circuit can be used across any impedance transmission line. The *total* value of the resistances needed is calculated using Ohm's law, knowing the approximate transmitter power output, the impedance of the transmission line, and using a figure of 1 Watt for the power consumed in the bulb circuitry. The values of R1 and R4 will be 1k or more for any transmitter output of 100 Watts or more, so these resistors, which should be a fixed carbon type, isolate the circuitry from the transmission line so no loading effects are noticed. The resistor directly across the bulbs can be any sort of carbon trimmer pot or regular carbon pot rated at 1 Watt or more.

The ideal way to adjust the ignition point of the bulbs initially is with a monitoring scope. Adjust R2 so the bulb associated with it lights fully when a normal modulation level is achieved with no flat-topping. Adjust R3 so its bulb just starts to glow when flat-topping just occurs. The adjustments may interact a bit, so one has to go back and forth a few times to check the settings. An alternative to the scope method is to insert a carrier so the transmitter draws 80-90% of its normal dc input. Then adjust R2 to light its bulb. Further, reinsert the carrier for the full dc input and adjust R3 so its bulb ignites. The latter ignition point should be checked by some on-the-air checks, if possible, to ensure that it warns when overmodulation starts to cause splatter.

The circuit of Fig. 1(a) works best with linears having about 150 Watts or more PEP output. For PEP output levels of down to 60-70 Watts, the simple circuit of Fig. 1(b) is used. It also uses a NE-17 neon which ignites at a slightly lower voltage (55 volts) than the usual NE-2 (65 volts) and has a larger glow surface. As before, one bulb is set to indicate normal modulation and the other to indicate the danger of flat-topping. 1k isolating resistors are used and the variable resistor calculated on the basis of the

voltage across the line (calculated on the basis of the line impedance and the PEP output) and the fact that the neons use about ¼ Watt of power.

A point to watch when using either neon circuit is that the variable resistors will set the ignition point of the neons, but the extinguishing voltage depends on the characteristics of the neon bulbs. Before finalizing a circuit, check that the extinguishing voltage of the neon used for flat-top warning is the higher of the two particular bulbs used. Otherwise, one can get a slightly confusing indication where the flat-top bulb, once a peak ignites it and the normal modulation bulb, will remain glowing for an instant after even the normal modulation bulb extinguishes.

LEDs can be used instead of neons and present both advantages and disadvantages. The disadvantages are the size of the indicators and that LEDs do not have quite such a distinct or sharp turn-on point as many neons. But, LEDs draw less power and can be used down to quite low power levels. By using a green LED for normal modulation and a red LED for flat-top warning, an interesting display can be created.

The LEDs, being dc devices, require a rectifier circuit as shown in Fig. 1(c). The approximate total value of the variable resistor needed can be calculated on the same basis as before, except that the typical LED will require about .03 Watts for operation (1.5 volts at 20 mA).

Whatever circuit is chosen, it must be properly shielded since one is tapping into the transmitter transmission line. The circuitry required is so small that in many cases the circuitry can be enclosed within a transmitter, an swr bridge, or an antenna matching device. In the case of the LEDs only, they can be remotely located once the sampled rf signal is rectified. So, the rectifier circuitry could be located by the antenna terminal of a transmitter and the LEDs on the front panel. An alternative is to use a small minibox enclosure which has a coax receptacle and use a standard T connector to break into the transmission line.■

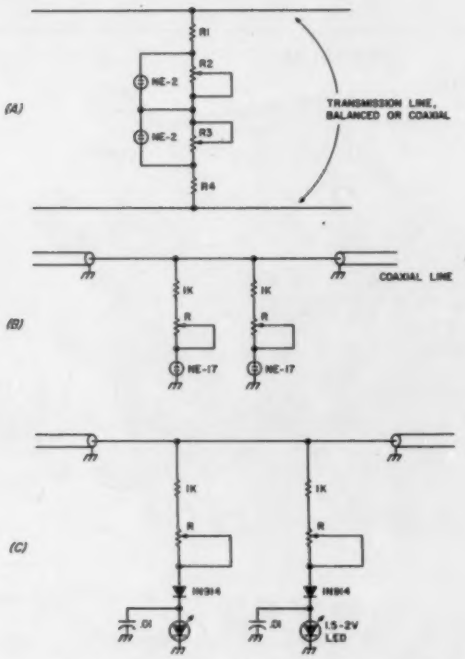

Fig. 1. Various neon and LED PEP indicating circuits.

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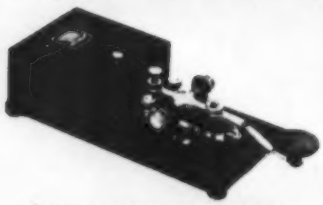

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75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
75-10 HD (SP)	75/40/20/15/10	74.50	48/1.34	66/20.1
**80-10 HD	80/40/20/15/10	78.50	50/1.40	68/21.0

NOTES
1. Models prefaced ' ** ' will be available 1/77.
2. All models above are furnished with crimp/solder lugs.
3. All models can be furnished with a SO-239 female coaxial connector at additional cost. The SO-239 mates with the standard PL-259 male coaxial cable connector. To order this factory installed option, add the letter 'A' after the model number. Example: 40-20 HD/A.
4. 75 meter models are factory tuned to resonate at 3860 kHz. (SP) models are factory tuned to resonate at 3800 kHz. 80 meter models are factory tuned to resonate at 3660 kHz. See VSWR curves for other resonance data.

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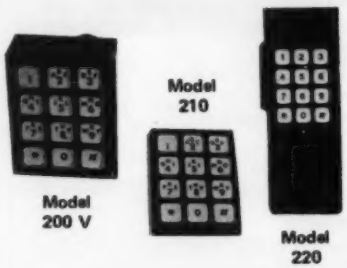

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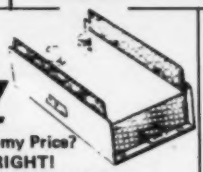

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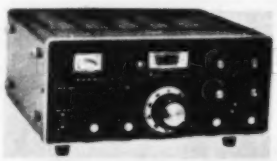

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Continuous Current	1.5 Amp	
Regulation	2.5 Amp	
Ripple/Noise	5 mV RMS	10 mV RMS

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

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Functions silently in converting 115 volts AC to 12 volts DC. 4 amps continuous, 6 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette player or car radio in a home or office.

Continuous Current (Full Load)	4 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	10,000 uF
Ripple (Full Load)	.5 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 5 lbs.

MODEL 103R

NPC 4 Amp Regulated Power Supply. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 2.5 amps continuous and 4 amps max. Ideally suited for applications where no hum and DC stability are important such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	2.5 Amp	
Current Limit	4 Amp	
Current Foldback	1 Amp	

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

MODEL 109R

NPC 25 Amp Regulated Power Supply. 4-Way Protected. Output Voltage and Current Meters.

Extra heavy-duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 10 amps continuous, 25 amps max. All solid state. Features dual current overload, overvoltage and thermal protection. Ideally suited for operating mobile Ham radio and linear amplifier in your home or office. Excellent bench power supply for testing and servicing of mobile communications equipment.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	50 mV	100 mV
Ripple Noise	5 mV RMS	10 mV RMS
Transient Response	20 uSec	
Current Continuous	10 Amp	
Current Limit	25 Amp	
Overvoltage Protection	14.5 V	15 V
Thermal Overload	180°F	

Case: 4¾" (H) x 9" (W) x 8½" (D). Shipping Weight: 15 lbs.

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Functions silently in converting 115 volts AC to 12 volts DC. Ideally suited for most applications including 8-track stereo, burglar alarm, car radio and cassette tape player within power rating.

Continuous Current (Full Load)	1.75 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.4 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 108RM

NPC 12 Amp Regulated Power Supply. Solid State. 3-Way Protected. Current Meter.

This heavy duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 8 amps continuous, 12 amps max. All solid state. Features dual current overload and overvoltage protection. Ideally suited for operating mobile Ham radio 2 meter AM-FM-SSB transceivers in your home or office. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	8 Amp	
Current Limit	12 Amp	
Current Foldback	2.5 Amp	
Overvoltage Protection	14.5 V	15 V

Case: 4¼" (H) x 7½" (W) x 5½" (D). Shipping Weight: 9.5 lbs.

ALSO AVAILABLE AS MODEL 108RA WITHOUT METER AND OVERVOLTAGE PROTECTION.

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	MAXIMUM	TYPICAL
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	4 Amp	
Current Limit	6 Amp	
Current Foldback	2 Amp	

Case: 3½" (H) x 5½" (W) x 6½" (D). Shipping Weight: 6 lbs.

MODEL 102

NPC 2.5 Amp Power Supply. 4 Amp Max. Solid State. Overload Protected.

Functions silently in converting 115 volts AC to 12-volts DC. 2.5 amps continuous, 4 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette tape player or car radio in a home or office.

Continuous Current (Full Load)	2.5 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.6 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

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MODEL 12-115

NPC 12-115 Solid State Inverter. 200 W. Parallel Connection for Higher Power up to 350 W.

Converts 12 volts DC to 115 volts AC @ 60 Hz output. 200 watts continuous operation with peak power up to 240 watts. All silicon semiconductors assure high reliabiltiy at excessive ambient temperatures. The output voltage is a square wave. The inverter is not recommended where high transients are not tolerable.

The 12-115 allows you to have AC house current in your boat, car, truck, camper, house trailer, or houseboat. Will operate small household appliances, T.V., hand tools, electric shaver, AC radios, and lights within power rating. Built-in overload protection.

	12 VDC IN	14 VDC IN
Output Voltage (No Load)	115 V RMS	130 V RMS
Output Voltage (Full Load)	100 V RMS	115 V RMS
Frequency (No Load)	58 Hz	66 Hz
Frequency (Full Load)	54 Hz	62 Hz
Power Continuous	200W	
Power Peak	240W	
Parallel Connection	350W	

All Values Are Typical

Case: 4½" (H) x 7½" (W) x 5½" (D). Shipping Weight: 7 lbs.

MODEL 612

Model 612
Power Converter

NPC 612 converts 6 volt negative ground or 12 volt positive ground electrical systems to 12 volt negative ground operation. Provides full 3 amp continuous power. The inexpensive solution for installing car radios, stereo and cassette tape players in vehicles with 6 volt negative ground or 12 volt positive ground systems.

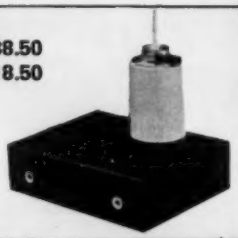
Case: 2¾" (H) x 3" (W) x 5" (D). Shipping Weight: 1 lb.

Larsen Antennas
to fit Any Mobile Unit

Larsen Antennas

Magnetic Mount or Gutter Clamp 5/8 wave — $38.50
Specify, 2 meters, 220, 450. 1/4 wave — $18.50

3/8" single hole mount
5/8 wave — $31.50
1/4 wave — $11.50



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model 372 CLIPREAMP

Model 372 — $27.50

Get maximum legal modulation without danger of splatter. Solid-state speech preamplifier and clipper for transmitters, public-address systems, and tape recorders needs no external power.

- specifications

Input Impedance	100,000 ohms
Input Levels	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	3-3/4" x 3" x 4-1/2"
Shipping Weight	7 oz.
Connectors	Terminal strip

COAXIAL ANTENNA CHANGEOVER RELAY

model 377

Model 377 — $17.95

Economical and reliable. Can be operated from VOX circuit for completely automatic operation or from PTT or manual T/R switch. Receiver input is automatically grounded when the relay is in the Transmit position. Wide AC operating voltage range and low operating current.

- specifications

Power Rating	1000 watts CW (2000 watts SSB)
VSWR	Less than 1.1:1, DC to 150 MHz
Power Requirements	6.3 VA Ampere, 48 to 120 volts AC
Connectors	UHF Type SO-239
Dimensions	3-1/2" x 1-1/2"
Shipping Weight	1 lb.

UNIVERSAL HYBRID COUPLER II PHONE PATCH

model 300-2W and model 300-1W

Connect your station to the telephone lines. Five switch-selectable modes give complete flexibility for patching the station to the line and for tape recording and playback to or from the line or the station. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in *Compreamp* speech preamplifier/limiter (in Model 300-2W) increases the level of weak phone signals and also prevents overmodulation when the local telephone is used as the station microphone. (The *Compreamp* also functions as a preamplifier/limiter with the station microphone, if desired.)

- specifications

Inputs from:	
Line	600 ohms
Receiver	4 ohms
Microphone	High impedance (50,000 ohms) crystal or dynamic
Tape Recorder	4 ohms
Outputs to:	
Transmitter	50,000 ohms
Receiver Speaker	4 ohms
Tape Recorder	0.5 megohm
Size	9-1/2" x 7-1/2" x 3"
Shipping Weight	3-1/2 lbs.
Power	9-volt battery, Burgess 2U6 or equivalent
Connectors	Phone

Model 300 2W with *Compreamp* — $125.00

Model 300 1W without *Compreamp* — $85.00

B&W

BARKER & WILLIAMSON, INC.

Model 359 — $37.50

Increase your transmitter's effective speech power up to four times. Or use it with your tape recorder or public address system for improved performance. This two-stage, transistorized Audio Preamplifier/Limiter can be used with all types of transmitters. Powered by a long-lasting dry-cell battery—no external power needed. Installs without any wiring changes in your transmitter. Just connect the *Compreamp* between your microphone (50,000-ohm dynamic or high-impedance ceramic) and your transmitter's microphone input connector. Front-panel rocker switch lets you bypass the *Compreamp* when you want to. Compression level is adjustable, too.

- specifications

Input Impedance	100,000 ohms
Input Level	5 millivolts to 25 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	3-3/4" x 3" x 4-1/2"
Shipping Weight	6-1/2 oz.
Connectors	Terminal strip

COAXIAL SWITCHES AND ACCESSORIES

for antenna selection and RF switching

These high-quality switches have set the standard for the industry for years. Ceramic switches with silver-alloy contacts and silver-plated conductors give unmatched performance and reliability from audio frequencies to 150 MHz.

B&W coaxial switches are designed for use with 52- to 75-ohm non-reactive loads, and are power rated at 1000 watts AM, 2000 watts SSB. Connectors are UHF type. Insertion loss is negligible, and VSWR is less than 1.2:1 up to 150 MHz.

Crosstalk (measured at 30 MHz) is -45 dB between adjacent outlets and -60 dB between alternate outlets.

Models are available for desk, wall, or panel mounting, and with or without protective grounding of inactive outputs. Radial (side-mounted) connector models can be either wall or panel mounted; axial (backplate-mounted) connector models are for panel mounting only, save panel space.

Use the selector chart below to choose the models you need.

Model 550A

Model 551A

Model 590

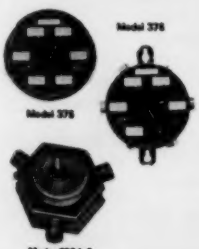
Model 590G

Model 592

Model 595

COAXIAL SWITCH SELECTOR CHART

Model	PRICE	Outputs	Connector Placement	Mounting: Panel	Mounting: Wall	Mounting: Desk	Automatic Grounding	Dial Plate	Remarks
375	18.95	8	Axial	x			x	Supplied	PROTAX switch. Grounds all except selected output circuit.
376	18.95	5	Radial	x	x		x	Supplied	PROTAX switch. Grounds all except selected output circuit. Sixth switch position grounds *all* outputs.
550A	14.00	5	Radial	x	x			DP-5	
550A-2	12.50	2	Radial	x	x			DP-2	
551A	17.50	2	Radial	x	x			DP-2	Special 2-pole, 2-position switch used to switch any RF device in or out of series connection in a coaxial line. See figure (over).
558	.95	–	–		x			–	Bracket only, for wall mounting of radial connector switches.
590	17.95	5	Axial	x				DP-5	
590G	17.95	5	Axial	x			x	Supplied	Grounds all except selected output circuit.
592	16.50	2	Axial	x				DP-2	
595	18.50	6	In-line		x	x	x		Grounds all except selected output circuit.



TUFTS RADIO CATALOG TUFTS RADIO

There is no substitute for quality, performance, or the satisfaction of owning the very best.

Hence, the incomparable Hy-Gain 3750 Amateur transceiver. The 3750 covers all amateur bands 1.8-30 MHz (160-10 meters). It utilizes advanced Phase-Lock-Loop circuitry with dual gate MOS FET's at all critical RF amplifier and mixer stages. There's a rotating dial for easy band-scanning and an electronic frequency counter with digital readout and a memory display that remembers frequencies at the flip of a switch. And that's just the beginning.

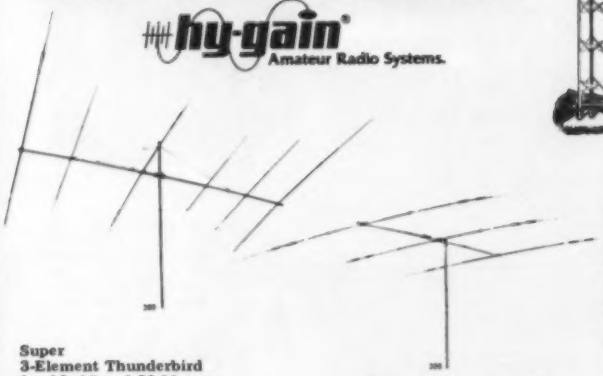
Matching speaker unit (3854) and complete external VFO (3855) also available.

See the incomparable Hy-Gain 3750 at your radio dealer or write Department MM. There is no substitute.

3854 – $69.95 3750 – $1895.00 3855 – $495.00

There is no substitute.

hy-gain® Amateur Radio Systems.



Super 3-Element Thunderbird for 10, 15 and 20 Meters Model TH3Mk3 — $199.95

Hy-Gain's Super 3-element Thunderbird delivers outstanding performance on 10, 15 and 20 meters. The TH3Mk3 features separate and matched Hy-Q traps for each band, and feeds with 52 ohm coax. Hy-Gain Beta Match presents tapered impedance for most efficient 3 band matching, and provides DC ground to eliminate precipitation static. The TH3Mk3 delivers maximum F/B ratio, and SWR less than 1.5:1 at resonance on all bands. Its mechanically superior construction features taper swaged slotted tubing for easy adjustment and larger diameter. Comes equipped with heavy tiltable boom-to-mast clamp. Hy-Gain ferrite balun BN-86 is recommended for use with the TH3Mk3.

	TH6DXX	TH3Mk3
Electrical		
Gain—average	8.7dB	8dB
Front-to-back ratio	25dB	25dB
SWR (at resonance)	Less than 1.5:1	Less than 1.5:1
Impedance	50 ohms	50 ohms
Power rating	Max legal	Max legal
Mechanical		
Longest element	31.1'	27'
Boom length	24'	14'
Turning radius	20'	15.7'
Wind load at 80 MPH	156 lbs.	103.2 lbs.
Maximum wind survival	100 MPH	100 MPH
Net weight	57 lbs.	36 lbs.
Mast diameter accepted	1¼" to 2½"	1¼" to 2½"
Surface area	6.1 sq. ft.	4.03 sq. ft.

6-Element Super Thunderbird DX for 10, 15 and 20 Meters Model TH6DXX

$239.95 Separate Hy-Q traps, featuring large diameter coils that develop an exceptionally favorable L/C ratio and very high Q, provide peak performance on each band whether working phone or CW. Exclusive Hy-Gain beta match, factory pretuned, insures maximum gain and F/B ratio without compromise. The TH6DXX feeds with 52 ohm coaxial cable and delivers less than 1.5:1 SWR on all bands. Mechanically superior construction features taper swaged, slotted tubing for easy adjustment and re-adjustment, and for larger diameter and less wind loading. Full circumference compression clamps replace self-tapping sheet metal screws. Includes large diameter, heavy gauge aluminum boom, heavy cast aluminum boom-to-mast clamp, and heavy gauge machine formed element-to-boom brackets. Hy-Gain's ferrite balun BN-86 is recommended for use with the TH6DXX.

HY-GAIN'S INCOMPARABLE HY-TOWER FOR 80 THRU 10 METERS

Model 18HT
- **Outstanding Omni-Directional Performance**
- **Automatic Band Switching**
- **Installs on 4 sq. ft. of real estate**
- **Completely Self-Supporting**

By any standard of measurement, the Hy-Tower is unquestionably the finest multi-band vertical antenna system on the market today. Virtually indestructible, the Model 18HT features automatic band selection on 80 thru 10 meters through the use of a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple of a ¼ wavelength) exists on all bands. Fed with 52 ohm coax, it takes maximum legal power ... delivers outstanding performance on all bands. With the addition of a base loading coil, it also delivers outstanding performance on 160 meters. Structurally, the Model 18HT is built to last a lifetime. Rugged hot-dipped galvanized 24 ft. tower requires no guyed supports. Top mast, which extends to a height of 50 Ft., is 6061ST6 tapers aluminum. All hardware is iridite treated to MIL specs. If you're looking for the epitome in vertical antenna systems, you'll want Hy-Tower. Shpg. Wt., 96.7 lbs. Order No. 182 Price: $259.95
NEW Special hinged base assembly on Model 18HT allows complete assembly of antenna at ground level ... permits easy raising and lowering of the antenna.

BROAD BAND DOUBLET BALUN
for 10 thru 80 meters
Model BN-86
$15.95

The model BN-86 balun provides optimum balance of power to both sides of any doublet and vastly improves the transfer of energy from feedline to antenna. Power capacity is 1 KW DC. Features weatherproof construction and built-in mounting brackets. $15.95 Shpg. Wt. 1 lb. Order No. 242

MULTI-BAND HY-Q TRAP DOUBLETS
Hy-Q Traps

- **Install Horizontally or as Inverted V**
- **Super-Strength Aluminum Clad Wire**
- **Weatherproof Center and End Insulators**

Installed horizontally or as an inverted V, Hy-Gain doublets with Hy-Q traps deliver true half wavelength performance on every design frequency. Matched traps, individually pretuned for each band feature large diameter coils that develop an exceptionally favorable L/C ratio and very high Q performance. Mechanically superior solid aluminum trap housings provide maximum protection and support to the loading coil. Fed with 52 ohm coax, Hy-Gain doublets employ super-strength aluminum clad single strand steel wire elements that defy deterioration from salt water and smoke ... will not stretch ... withstand hurricane-like winds. SWR less than 1.5:1 on all bands. Strong, lightweight, weatherproof center insulators are molded from high impact cyolac. Hardware is iridate treated to MIL specs. Heavily serrated 7-inch end insulators molded from high impact cyolac increase leakage path to approximately 12 inches.

MODEL 2BDQ for 40 and 80 meters. 100' 10½" overall. Takes maximum legal power. Shpg. Wt., 7.5 lbs $49.95 Order No. 380
MODEL 5BDQ for 10, 15, 20, 40 and 80 meters. 94' overall. Takes maximum power. Shpg. Wt., 12.2 lbs. $79.95 Order No. 383

CENTER INSULATOR for Multi-Band Doublets Model CI

Strong lightweight, weatherproof Model CI is molded from high impact cycolac. Hardware is iridite treated to MIL specs. Accepts ¼" or ¾" coaxial. Shpg. Wt., 0.6 lbs. $5.95 Order No. 155

MULTI-BAND ANTENNA
Dipole Antenna — Model DIV-80
$13.95
For 10 thru 80 meters — choice of one band

A dipole antenna for the individuals who prefer the "do-it-yourself" flexibility of custom-designing an antenna for your specific needs. (Work the frequencies you wish in the 10 through 80 meters bands).
The DIV-80 features: Durable Copperweld wire for greater strength, Mosley Dipole Connector (DPC-1) for RG-8/U or RG-58/U coax and all the technical information you will need to construct your custom-designed antenna.

END INSULATORS for Doublets Model EI

Rugged 7-inch end insulators are molded from high impact cycolac that is heavily serrated to increase leakage path to approximately 12 inches. Available in pairs only. Shpg. Wt., 0.4 lbs. $3.95 Order No. 156

- *Remote*
- *Motor Controlled*

RCS-4

COAX ANTENNA SWITCH

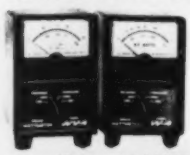
- Control unit works on 110/220 VAC, 50/60 Hz, and supplies necessary DC to motor.
- Excellent for single coax feed to multiband quads or arrays of monobanders. The five positions allow a single coax feed to three beams and two dipoles, or other similar combinations.
- Control cable (not supplied) same as for HAM-M rotator.
- Selects antennas remotely, grounds all unused antennas. GND position grounds all antennas when leaving station. "Rain-Hat" construction shields motor and switches.
- Motor: 24 VAC, 2 amp. Lubrication good to −40°F.
- Switch RF Capability: Maximum legal limit. **Price: $120.00**

MATCHING NETWORKS

MN-4
200 watts
Price: $110.00

MN-2000
2000 watts PEP
Price: $220.00

General: ● **Integral Wattmeter** reads forward power in watts and VSWR directly; can be calibrated to read reflected power ● **Matches 50 ohm transmitter output** to coax antenna feedline with VSWR of at least 5:1 ● Covers ham bands 80 thru 10 meters ● **Switches in or out** with front panel switch ● **Size:** 5½"H, 10⅝"W, 8"D (14.0 x 27.3 x 20.3 cm), MN-2000, 14⅛"D (36.5 cm).
● **Continuous Duty Output:** MN-4, 200 watts; MN-2000, 1000 watts (2000 watts PEP) ● **MN-2000 only:** Up to 3 antenna connectors selected by front panel switch.



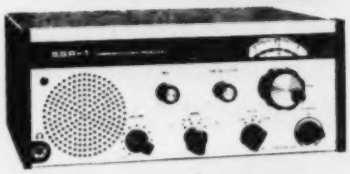
RF WATTMETERS

W-4 1.8-54 MHz **Price: $ 72.00**
WV-4 20-200 MHz **Price: $ 84.00**

Reads forward and reflected power directly in watts (VSWR from nomogram). Two scales in each direction. **Size:** 5½"H, 3⅛"W, 4"D (14.0 x 9.5 x 10.2 cm).

Model	Full Scale	Calibration Accuracy
W-4	200 watts 2000 watts	±(5% of reading + 2 watts) ±(5% of reading + 20 watts)
WV-4	100 watts 1000 watts	±(5% of reading + 1 watt) ±(5% of reading + 10 watts)

DRAKE



- **Synthesized • General Coverage**
- **Low Cost • All Solid State • Built-in AC Power Supply • Selectable Sidebands**
- **Excellent Performance**

PRELIMINARY SPECIFICATIONS: • **Coverage:** 500 kHz to 30 MHz • **Frequency** can be read accurately to better than 5 kHz • **Sensitivity** typically .5 microvolts for 10 dB S+N/N SSB and better than 2 microvolts for 10 dB S+N/N AM • **Selectable sidebands** • **Built-in power supply:** 117/234 VAC ± 20% • **If the AC power source fails** the unit switches automatically to an internal battery pack which uses eight D-cells (not supplied) • **For reduced current drain** on DC operation the dials do not light up unless a red pushbutton on the front panel is depressed.

The performance, versatility, size and low cost of the SSR-1 make it ideal for use as a stand-by amateur or novice-amateur receiver, short wave receiver, CB monitor receiver, or general purpose laboratory receiver.

Price: $350.00

SSR-1 COMMUNICATIONS RECEIVER

GENERAL: ● **All amateur bands** 10 thru 80 meters in seven 600 kHz ranges ● **Solid State VFO** with 1 kHz dial divisions ● **Modes** SSB Upper and Lower, CW and AM ● **Built-in Sidetone** and automatic T/R switching on CW ● **30 tubes and semi-conductors** ● **Dimensions:** 5½"H, 10¾"W, 14⅛" D (14.0 x 27.3 x 36.5 cm), **Wt.:** 16 lbs. (7.3 kg).
TRANSMIT: ● **VOX or PTT** on SSB or AM ● **Input Power:** SSB, 300 watts P.E.P.; AM, 260 watts P.E.P. controlled carrier compatible with SSB linears; CW, 260 watts ● **Adjustable pi-network.**
RECEIVE: ● **Sensitivity** better than ½ μV for 10 dB S/N ● **I.F. Selectivity** 2.1 kHz @ 6 dB, 3.8 kHz @ 60 dB. ● **AGC** full on receive modes, variable with RF gain control, fast attack and slow release with noise pulse suppression ● **Diode Detector** for AM reception.

Price: $649.00

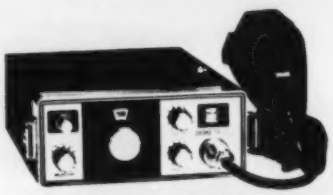
TR-4CW SIDEBAND TRANSCEIVER

34-PNB Plug-in Noise Blanker	100.00
FF-1 Crystal Control Unit	46.95
MMK-3 Mobile Mount	7.00
RV-4C Remote VFO	120.00

POWER SUPPLIES

AC-4 Power Supply	$120.00
DC-4 Power Supply	135.00

2 METER FM PORTABLE TRANSCEIVER Model TR-33C



Amateur Net $229.95

- SCPC* Frequency Control
- 12 Channels with Selectable Xmtr Offsets.
- All FET Front-end and Crystal Filter for Superb Receiver Intermod Rejection.
- Expanded Antenna Choice.
- Low Receiver Battery Drain.
- Traditional R. L. Drake Service Backup.
- Single Crystal Per Channel.

LINEAR AMPLIFIER Model L-4B

L-4B Linear Amplifier 895.00
● **2000 Watts PEP-SSB** ● **Class B Grounded-Grid — two 3-500Z Tubes** ● **Broad Band Tuned-Input** ● **RF Negative Feedback** ● **Transmitting AGC** ● **Directional Wattmeter** ● **Two Tautband Suspension Meters** ● **L-4B 13-15/16" W, 7-7/8" H, 14-5/16" D. Wt.: 32 lbs.** ● **Power Supply 6-3/4" W, 7-7/8" H, 11" D, Wt.: 43 lbs.**

POWER SUPPLIES

AC 4 Power Supply	$120.00
DC 4 Power Supply	135.00

Touch-n-go with DRAKE 1525EM Push Button Encoding Mike

Drake 1525EM, microphone with tone encoder and connector for TR-33C, TR-22, TR-22C, ML-2 ..... $49.95

- Microphone and auto-patch encoder in single convenient package with coil cord and connector. Fully wired and ready for use.
- High accuracy IC tone generator, no frequency adjustments.
- High reliability Digitran® keyboard.
- Power for tone encoder obtained from transceiver through microphone cable. No battery required. Low current drain.
- Low output impedance allows use with almost all transceivers.
- Four pin microphone plug: directly connects to Drake TR-33C without any modification in transceiver. Compatible with all previous Drake and other 2 meter units with minor modifications.
- Tone level adjustable.
- Hang-up hook supplied.

TUFTS RADIO CATALOG TUFTS RADI

TUFTS RADIO CATALOG TUFTS RADIO

why waste watts?

(SWR-1A $24.95)

SWR-1 guards against power loss

If you're not pumping out all the power you're paying for, our little SWR-1 combination power meter and SWR bridge will tell you so. You read forward and reflected power simultaneously, up to 1000 watts RF and 1:1 to infinity VSWR at 3.5 to 150 MHz.

Got it all tuned up? Keep it that way with SWR-1. You can leave it right in your antenna circuit.

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation

DELUXE 742 TRI-BAND MOBILE ANTENNA

- Automatically adjusts to proper resonance for 20, 40 and 75 meters.
- Power rated at 500 Watts P.E.P.
- Includes base section, automaticoil and whip top section. 742 Antenna

Price: $109.95

EXCLUSIVE DELUXE 5-BAND MOBILE 45 ANTENNA

- All band manual switching antenna for 10, 15, 20, 40 and 75 meters.
- Power rated at 1000 Watts P.E.P.
- Includes base section with mobilecoil and six foot whip top section. 45 Antenna

Price: $119.95

SWAN METERS HELP YOU GET IT ALL TOGETHER

These wattmeters tell you what's going on.

With one of these in-line wattmeters you'll know if you're getting it all together all the time. Need high accuracy? High power handling? Peak power readings? For whatever purpose we've got the wattmeter for you. Use your Swan credit card. Applications at your dealer or write to us.

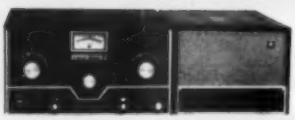
WM1000 In-line Watt meter With Muscle. Scales to 2000 watts. New flat response directional coupler for maximum accuracy. $59.95

WM1000 Peak reading Wattmeter. Reads RMS power, then with the flick of a switch, true peak power of your single-sideband signal. That's what counts on SSB. $79.95

WM1500 High Accuracy In-Line Wattmeter. Fits 6m scale accuracy on 5, 50, 500 and 1500 watt scales 2 to 30 MHz. Forward and reflected power. Use it for trouble-shooting, too. $74.95

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation

SWAN LINEAR AMPLIFIERS A Mark II 2000 watt P.E.P. full legal input power unit or the 1200X matching Cygnet 1200 watt P.E.P. input powerhouse with built-in power supply. The choice is yours. $849.95



NEW Swan MMBX Impedance Matcher

It keeps your transmitter and your antenna on speaking terms for a song. Price: $23.95

CYGNET 1200X PORTABLE LINEAR AMPLIFIER

To quadruple the output of the 300B Cygnet *de novo*, simply add this matching unit for more than a kilowatt of power. Complete with self-contained power supply and provision for external ALC, this Cygnet offers exceptionally high efficiency and linearity. $349.95

Additional Swan products include: fixed and mobile antennas, VFO's telephone patch, VOX, wattmeter, microphones and mounting kits. As another extra service, only Swan Electronics offers factory-backed financing to the amateur radio community. Visit an authorized Swan Electronics dealer for complete details

SWAN® ELECTRONICS

JMR MOBIL-EAR™

Two-way-radio headset with superior fidelity Electret-Capacitor boom microphone and palm-held talk switch.

$69.95

FOR BROADCAST-QUALITY TRANSMISSION AND RECEPTION FOR BOTH MOBILE UNITS AND BASE STATIONS.

- Boom-mounted electret-capacitor microphone delivers studio-quality, undistorted voice reproduction. Variable gain control lets you adjust for optimum modulation.
- Cushioned earcup lets you monitor in privacy – no speaker blare to disturb others. Blocks out environmental noises, too. Made of unbreakable ABS plastic.
- Headband self-adjusts for comfortable wear over long hours. Spring-flex hinge lets you slip headset on and off with just one hand. Reversible for right or left ear.
- Headset can be hung on standard microphone clip.
- Compact palm-held talk switch lets you keep *both* hands on the wheel for safer driving. Made of unbreakable ABS plastic.
- Built-in FET transistor amplifier adapts microphone output to any transceiver impedance.
- Compatible with most two-way radios including 40-channel CB units.
- Built-in Velcro pad for easy mounting of the talk switch.
- Made in U.S.A.

SPECIFICATIONS

Earphone impedance and type:	8 ohms, dynamic
Microphone type:	Electret capacitor
Microphone frequency response:	200–6000 Hz
Amplifier type:	FET transistor, variable gain
Amplifier battery power:	7-volt Mallory TR-175
Switching:	Relay or electronic

IDEAL FOR EVERY TWO-WAY RADIO COMMUNICATIONS NEED . . .

CB operators • Amateur radio operators • Police and fire vehicles • Ambulances and emergency vehicles • Taxis and truckers • Marine pleasure and work boats • Construction and demolition crews • Industrial communications • Security patrols • Airport tower and ground crews • Remote broadcast and TV-camera crews • Foresters and fire-watch units •

ARGONAUT #509

AMPLIFIER #405

TEN-TEC

ARGONAUT, MODEL 509

Covers all Amateur bands 10-80 meters. 9 MHz crystal filter. 2.5 kHz bandwidth. 1.7 shape factor @ 6/50 dB points. Power required 12-15 VDC @ 150 mA receive, 800 mA transmit at rated output. Construction: aluminum chassis, top and front panel, molded plastic end panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 13" x 7". Weight 6 lbs.

LINEAR AMPLIFIER, MODEL 405

Covers all Amateur bands 10-80 meters. 50 watts output power, continuous sine wave. RF wattmeter. SWR meter. Power required 12-15 VDC @ 8 A, max. Construction: aluminum chassis, top and front panel, molded plastic side panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 7" x 8". Weight 2½ lbs.

Argonaut, Model 509	$329.00
Linear Amplifier, Model 405	159.00
Power Supply, Model 251 (Will power both units)	79.00
Power Supply, Model 210 (Will power Argonaut only)	27.50

The new ultra-modern fully solid-state TRITON makes operating easier and a lot more fun, without the limitations of vacuum tubes.

For one thing, you can change bands with the flick of a switch and no danger of off-resonance damage. And no deterioration of performance with age.

But that's not all. A superlative 8-pole i-f filter and less than 2% audio distortion, transmitting and receiving, makes it the smoothest and cleanest signal on the air.

The TRITON IV specifications are impeccable. For selectivity, stability and receiver sensitivity. And it has features such as *full* CW break-in, pre-selectable ALC, off-set tuning, separate AC power supply, 12 VDC operation, perfectly shaped CW wave form, built-in SWR bridge and on and on.

For new standards of SSB and CW communication, write for full details or talk it over with your TEN-TEC dealer. We'd like to tell you why "They Don't Make 'Em Like They Used To" makes Ham Radio even more fun.

TRITON IV $699.00

ACCESSORIES:

Model 240 One-Sixty Converter	$ 97.00
Model 244 Digital Readout	197.00
Model 245 CW Filter	$ 25.00
Model 249 Noise Blanker	29.00
Model 252G Power Supply	99.00
Model 262G Power Supply/VOX	129.00

TEN-TEC

KR20-A ELECTRONIC KEYER

A fine instrument for all-around high performance electronic keying. Paddle actuation force is factory adjusted for rythmic smooth keying. Contact adjustments on front. Weighting factor factory set for optimum smoothness and articulation. Over-ride "straight key" conveniently located for emphasis, QRS sending or tune-up. Reed relay output. Side-tone generator with adjustable level. Self-completing characters. Plug-in circuit board. For 117 VAC, 50-60 Hz or 6-14 VDC. Finished in cream and walnut vinyl. Price $67.50

KR5-A ELECTRONIC KEYER

Similar to KR20-A but without side-tone oscillator or AC power supply. Ideal for portable, mobile or fixed station. A great value that will give years of troublefree service. Housed in an attractive case with cream front, walnut vinyl top. For 6-14 VDC operation. Price $38.50

KR1-A DELUXE DUAL PADDLE

Paddle assembly is that used in the KR50, housed in an attractive formed aluminum case. Price $35.00

KR2-A SINGLE LEVER PADDLE

For keying conventional "TO" or discrete character keyers, as used in the KR20-A. Price $15.00

KR50 ELECTRONIC KEYER

A completely automatic electronic keyer fully adjustable to your operating style and preference, speed, touch and weithting, the ratio of the length of dits and dahs to the space between them. Self-controlled keyer to transmit your thoughts clearly, articulately and almost effortless. The jambie (squeeze) feature allows the insertion of dits and dahs with perfect timing.

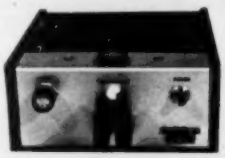
An automatic weighting system provides increased character to space ratio at slower speeds, decreasing as the speed is increased, keeping the balance between smoothness at low speeds and easy to copy higher speed. High intelligibility and rythmic transmission is maintained at all speeds, automatically.

Memories provided for both dits and dahs but either may be defeated by switches on the rear panel. Thus, the KR50 may be operated as a full iambic (squeeze) keyer, with a single memory or as a conventional type keyer. All characters are self-completing. Price $110.00

SPECIFICATIONS

Speed Range: 6-50 w.p.m.
Weighting Ratio Range: 50% to 150% of classical dit length.
Memories: Dit and dah. Individual defeat switches.
Paddle Actuation Force: 5-50 gms.
Power Source: 117VAC, 50-60 Hz, 6-14 VDC.
Finish: Cream front, walnut vinyl top and side panel trim.
Output: Reed relay. Contact rating 15 VA, 400 V. max.
Paddles: Torque drive with ball bearing pivot.
Side-tone: 500 Hz tone.
Adjustable output to 1 volt.
Size HWD: 2½" x 5¼" x 8¼"
Weight: 1¾ lbs.

TEN-TEC



KR50

NORTH SHORE RF TECHNOLOGY

DUPLEXER & CAVITY KITS...

NOW AVAILABLE FOR YOU FULLY ASSEMBLED & TUNED!

- UPGRADE YOUR REPEATER WITH AN RF TECHNOLOGY DUPLEXER.
- ALL DUPLEXERS AND CAVITIES ARE TEMPERATURE COMPENSATED WITH INVAR® AND MEET ALL COMMERCIAL STANDARDS
- ONLY TOP QUALITY MATERIALS GO INTO OUR PRODUCTS.
- BOTH KITS & ASSEMBLED DUPLEXERS AND CAVITIES ARE AVAILABLE TO YOU AT A SAVINGS TO YOU.

Mod. 62-3 . . . 6 cav., 2 mtr., insertion loss 0.6 db with isolation 100 db typical; pwr. 350 w. Kit $399 ea. — Assembled $499.

Mod. 4220-3 . . . 4 cav. 220 MHz insertion loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kit $279 ea. — Assembled $349.

Mod. 4440-3 . . . 4 cav. 440 MHz, insertion loss 0.6 db with 80 db isolation loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kits $249 ea. — Assembled $329.

Mod. 30 Cavity Kits: 2 mtr. $75 ea., 220 MHz $65 ea., 440 MHz $65 ea.; 6 mtr. $115 ea. Add $15 for Assembled Kit.

Also available: 6 mtr., 4 cav. Kit $399 — Assembled $499, 2 mtr. 4 cav. Kit $299 — Assembled $399, 440 MHz TV Repeater Duplexer.

Now You Can Receive The Weak Signals With The ALL NEW AMECO PREAMPLIFIER

Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with No modification. No serious ham can be without one.

- Improves sensitivity and signal-to-noise ratio.
- Boosts signals up to 26 db.
- For AM or SSB.
- Bypasses itself automatically when the transceiver is transmitting.
- FET amplifier gives superior cross modulation protection.
- Advanced solid-state circuitry.
- Simple to install.
- Improves immunity to transceiver front-end overload by use of its built-in attenuator.
- Provides master power control for station equipment.

MODEL PT-2

$69.95

The indispensable BIRD model 43 THRULINE® Wattmeter

MODEL		PRICE
43		$110
Elements (Table 1) 2-30 MHz		40
Elements (Table 1) 25-1000 MHz		35
Elements (Table 2)		50
80F, 80M	5W	27
8080 QC-N (M)	25W	47
8085 QC-N (M)	50W	75
Minimonitor®		149

Read RF Watts Directly.

0.45-2300 MHz, 1-10,000 watts ±5%, Low Insertion VSWR—1.05.

Unequalled economy and flexibility: Buy only the element(s) covering your present frequency and power needs, add extra ranges later if your requirements expand.

BIRD

Table 1 STANDARD ELEMENTS (CATALOG NUMBERS)

Power Range	Frequency Bands (MHz) 2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

Table 2 LOW-POWER ELEMENTS

1 watt	Cat. No.	2.5 watts	Cat. No.
60-80 MHz	060-1	60-80 MHz	060-2
80-95 MHz	080-1	80-95 MHz	080-2
95-125 MHz	095-1	95-150 MHz	095-2
110-160 MHz	110-1	150-250 MHz	150-2
150-250 MHz	150-1	200-300 MHz	200-2
200-300 MHz	200-1	250-450 MHz	250-2
275-450 MHz	275-1	400-850 MHz	400-2
425-850 MHz	425-1	800-950 MHz	800-2
800-950 MHz	800-1		

BOMAR Crystal Company

Novice Crystals (Specify Band Only)

TWO METERS

CRYSTALS IN STOCK

Motorola HT 220 Crystals In Stock!

Standard ● Icom ● Heathkit ● Ken ● Clegg ● Regency ● Wilson ● VHF Eng ● Drake ● And Others! $4.50 @ Lifetime Guarantee

Make/Model	Xmit Freq.	Rec. Freq.

THE BIG SIGNAL "W2AU" BALUN $12.95

THE APPROVED LEADING HAM AND COMMERCIAL BALUN IN THE WORLD TODAY.

THE PROVEN BALUN

1. HANDLES FULL 2 KW PEP AND THEN SOME. Broad-Banded 3 to 40 Mc.
2. HELPS TVI PROBLEMS By Reducing Coax Line Radiation
3. NOW ALL STAINLESS STEEL HARDWARE. SO239 Double Silver Plated
4. IMPROVES F/B RATIO By Reducing Coax Line Pick-Up
5. REPLACES CENTER INSULATOR. Withstands Antenna Pull of Over 600 Lbs.
6. BUILT-IN LIGHTNING ARRESTER. Helps Protect Balun — Could Also Save Your Valuable Gear
7. BUILT-IN HANG-UP HOOK. Ideal For Inverted Vees, Multi-Band Antennas, Dipoles, Beam and Coods.

NOW BEING USED BY ALL BRANCHES OF THE U.S. ARMED FORCES, FAA, RCA, CIA, CANADIAN DEFENSE DEPT. PLUS THOUSANDS OF HAMS THE WORLD OVER

THEY'RE BUILT TO LAST...

BIG SIGNALS DON'T JUST HAPPEN— GIVE YOUR ANTENNA A BREAK

Comes in 2 models. 1:1 matches 50 or 75 ohm unbalanced loads feed to 50 or 75 ohm balanced load. 4:1 model matches 50 or 75 ohm unbalanced loads feed to 200 or 300 ohm balanced load.

AVAILABLE AT ALL LEADING DEALERS. IF NOT, ORDER DIRECT

The big signal W2AU Balun reflects the type of quality that has kept our product well liked and number 1 in Balun the world over for the past 10 years.

The originator of the Balun with a built-in lightning arrester and hang up hook.

WE'LL GUARANTEE no other balun, at any price, has all these features.

IT'S WHAT'S INSIDE THAT COUNTS!

SERIES 31 — BNC CONNECTORS

Amphenol's BNC connectors are small, lightweight, weatherproof connectors with bayonet action for quick disconnect applifications.

Shells, coupling rings and male contacts are accurately machined from brass. Springs are made of beryllium copper. All parts in turn are ASTROplated® to give you connectors that can take constant handling, high temperatures and resist abrasion.

BNC BULKHEAD RECEPTACLE 31-221-385 UG-1094 Mates with any BNC plug. Receptacle can be mounted into panels up to 104" thick. $1.25

BNC (M) TO UHF (F) ADAPTER 309-2900-385 UG-225 Adapts any BNC jack to any UHF plug. $3.63

DOUBLE MATE ADAPTER 83-877-385 Both coupling rings are free turning. Connects 2 female components. $2.72

JACK ADPATER $1.95

575-102-385 Adapts 83-1SP-385 to Motorola type auto antenna jack or pin jack.

PANEL RECEPTACLE 83-1R-385 SO239 Mounts with 4 fasteners in 21/32" diameter hole. $1.17

PANEL RECEPTACLE 83-875-385 SO239SH Mounts in single 21/32" diameter hole. Knurled lock nuts prevent turning. $1.59

BNC ANGLE ADAPTER 31-009-385 UG-306 Adapts any BNC plug for right angle use. $4.23

BNC TEE ADAPTER 31-008-385 UG-274 Adapts 2 BNC plugs to 31-003-385 or other female BNC type receptable. $4.56

BNC(F) TO UHF (M) ADAPTER 31-028-385 UG-273 Adapts any BNC plug to any UHF jack. $2.39

PUSH-ON 83-1SP-385 83-5SP-385 Features an unthreaded, springy shell to push fit on female connectors. $2.27

LIGHTNING ARRESTOR 575-105-385 Eliminates static build-up from antenna. Protects your valuable equipment against lightning damage. $4.80

BNC PLUG 31-002-385 UG-88 Commonly used for communications antenna lead cables. For RG 55/U & RG 58/U cables. $1.59

BNC STRAIGHT ADAPTER 31-219-385 UG-914 1 9/32" long, allows length of cables to be joined. Mates with BNC plugs. $2.12

BNC PANEL RECEPTACLE 31-003-385 UG-290 Mounts with 4 fasteners in 29/64" diameter hole. $1.74

SERIES 581 — PACKAGED CABLE ASSEMBLIES

All popular lengths are now available in your choice of RG 8/U or RG 58/U type low loss polyfoam dielectric cable. Installed PL-259 connectors are ASTROplated — Amphenol's new non-tarnishing finish — which has all the advantages of precious metal plus more heat, corrosion and abrasion resistors that silver ever had! These cable assemblies are ideal for CB, ham radio and other communications antenna installations and they are ready for immediate use.

RG 8/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-803 3-ft. with ASTROplated PL-259's on both ends. $5.60

581-820 20-fit with ASTROplated PL-259's on both ends. $11.80

581-850 50-fit with ASTROplated PL-259's on both ends. $23.10

581-875 75-fit with ASTROplated PL-259's on both ends. $30.30

581-8100 100-ft. with ASTROplated PL-259's on both ends. $38.50

RG 58/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-5812 12-ft. with ASTROplated PL-259's on both ends. $6.34

581-5820 20-ft with ASTROplated PL-259's on one end and SPADE LUGS ON OTHER END. $6.30

518-5820-2 20-ft. with ASTROplated PL-259's on both ends. $7.36

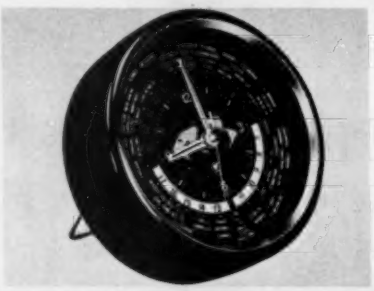
581-5850 50-ft. with ASTROplated PL-259's on both ends. $11.20

581-5875 75-ft. with ASTROplated PL-259's on both ends. $14.00

581-58100 100-ft. with ASTROplated PL-259's on both ends. $16.10

A new precision clock which tells time anywhere in the world at a glance, has been announced by **Yaesu Electronics Corporation**. The time in any principal city or time zone can be simultaneously coordinated with local time on a 24 hour basis. After the initial setting, as the clock runs, a Time Zone Hour Disc advances automatically, showing correct time all over the world without further adjustment. The clock is especially designed to withstand shock and may be hung on a wall or placed on its desk mount. The clock will run an entire year on a single 1.5 volt flashlight battery and the mechanism starts as soon as the battery is inserted. It measures six inches in diameter by two and one half inches deep. An excellent item for the business office, ham radio operator, short wave listener, boat owner, and others who want an accurate dependable clock.

Price: $30.00 Amateur net.



Now...more than ever--- the TEMPO line means solid value

Tempo VHF/ONE

the "ONE" you've been waiting for

$399.00

No need to wait any longer -- this is it! Whether you are already on 2-meter and want something better or you're just thinking of getting into it, the VHF/ONE is the way to go.

• Full 2-meter band coverage (144 to 148 MHz for transmit and receive. • Full phase lock synthesized (PLL) so no channel crystals are required. • Compact and lightweight -- 9.5" long x 7" wide x 2.25" high. Weight -- About 4.5 lbs. • Provisions for an accessory SSB adapter. • 5-digit LED receive frequency display. • 5 KHz frequency selection for FM operation. • Automatic repeater split -- selectable up or down for normal or reverse operation. • Microphone, power cord and mounting bracket included. • Two built-in programmable channels. • All solid state. • 10 watts output. • Super selectivity with a crystal filter at the first IF and 6 type ceramic filter at the second IF. • 800 Selectable receive frequencies. • Accessory 9-pin socket.

TEMPO SSB/ONE

$199.00

SSB adapter for the Tempo VHF/One

• Selectable upper or lower sideband. • Plugs directly into the VHF/One with no modification. • Noise blanker built-in. • RIT and VXO for full frequency coverage. •

ATLAS 350-XL

- ALL SOLID STATE
- SSB TRANSCEIVER
- 350 WATTS P.E.P. OR CW INPUT
- 10 THROUGH 160 METER COVERAGE

Illustrated with optional AC supply, Auxiliary VFO, and Digital Dial.

The all new Atlas 350-XL has all the exciting new features you want, plus superior performance and selectivity control never before possible.

● 10-160 METERS
Full coverage of all six amateur bands in 500 kHz segments. Primary frequency control provides highly stable operation. Also included is provision for adding up to 10 additional 500 kHz segments between 2 to 22 MHz by plugging in auxiliary crystals.

● 350 WATTS
P.E.P. and CW input. Enough power to work the world barefoot!

IDEAL FOR DESKTOP OR MOBILE OPERATION
Measuring just 5 in. high x 12 in. wide x 12½ in. deep, and weighing only 13 pounds, the Atlas 350-XL offers more features, performance and value than any other transceiver, regardless of size, on the market today!

● SELECTIVITY CONTROL
This amazing new breakthrough in filter design is truly the filter of the future. Selectivity control on the front panel provides control of bandwidth as well as selection of upper or lower sideband, or double sideband. Continuously variable from 300 to 2700 Hz bandwidth. Shape factor is better than 1.7, with ultimate rejection better than 130 dB. Selectivity for SSB can be set for maximum voice fidelity at 2700 Hz bandwidth, providing transmission and reception of audio from 300 to 3000 Hz, or it can be narrowed down to 2400, 2100 or even 1500 Hz if necessary to reduce adjacent channel QRM. Selectivity can be narrowed gradually to as little as 300 Hz for CW reception.

This amazing new breakthrough in filter design is by Bob Crawford and Eckert Argo of Consulting Engineers. Atlas Radio is privileged to be first to offer this "programmable filter" in the radio communication field and for sometime to come will be the only one.

- **RECEIVER INCREMENTAL TUNING**
- **AUDIO FREQUENCY NOTCH FILTER**
- **PUSH TO TALK**
- **VOX OPERATION**
- **FULL BREAK-IN CW OPERATION**

MODEL 350-XL **$995**

● DIGITAL DIAL READOUT
The Atlas 350-XL has space provided for quick installation of this plug-in accessory. Provides precise frequency readout within 50 Hz. All L.E.D. Dot Matrix 6 digit display.
DD6-XL DIGITAL DIAL **$195**

● PLUG-IN AUXILIARY VFO or CRYSTAL OSCILLATOR
Auxiliary VFO is plugged into the space provided on the front panel of the 350-XL. You have a second tuneable VFO with same tuning ranges as primary VFO for tuning to a separate transmit or receive frequency. LEDs indicate which VFO, primary or secondary, will be used for receive and transmit.

Or instead of the auxiliary VFO a Crystal Oscillator may be plugged into the front panel. Eleven crystal sockets are available with a vernier control for exact frequency setting.
MODEL 305 AUXILIARY VFO **$155**
MODEL 311 AUXILIARY CRYSTAL OSCILLATOR **$135**

● 350-PS MATCHING AC SUPPLY
Includes front facing speaker and phone jack. Provides 14 volts filtered and regulated D.C. for both low current and high current circuits of the 250-XL. Internal space provided for future installation of accessories such as CW Keyer, Speech Processor, Phone Patch, etc. Operates on 100-130 or 200-260 volts, 50-60 Hz .. **$195**

● SAME PLUG-IN-AND-GO MOBILE FEATURE AS OUR FAMOUS 210x/215x
The 350-XL has its own optional Mobile Mounting Bracket for quick, easy plug-in or removal from your car. All connections are made automatically **$65**

● ATLAS 210x/215x SSB TRANSCEIVERS
Our famous little compact SSB Transceivers remain a very important part of our product line **$679**
With noise blanker installed **$719**

No. 114-320-003 – $8.80
No. 114-322-003 – Brass – $10.20

No. 114-320-001 – $8.30
No. 114-322-001 – Brass – $9.65

No. 114-310-003 – $8.25
No. 114-312-003 – Brass – $9.65

No. SSK-1 $23.45
No. SSK-1CP Chrome – $29.95

NYE VIKING SQUEEZE KEY
Extra-long, finger-fitting molded paddles with adjustable spring tension, adjustable contact spacing. Knife-edge bearings and extra large, gold plated silver contacts! Nickel plated brass hardware and heavy, die cast base with non-skid feet. Base and dust cover black crackle finished. SSK-1 — $23.45.
SSK-1CP has heavily chrome-plated base and dust cover. List price, $29.95.

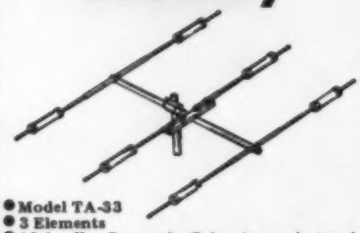
NYE VIKING SPEED-X KEYS
NYE VIKING Standard Speed-X keys feature smooth, adjustable bearings, heavy-duty silver contacts, and are mounted on a heavy oval die cast base with black wrinkle finish. Available with standard, or Navy knob, with, or without switch, and with nickel or brass plated key arm and hardware.

Pamper yourself with a Gold-Plated NYE VIKING KEY!
Model No. 114-31C-004GP has all the smooth action features of NYE Speed-X keys in a special "presentation" model. All hardware is heavily gold plated and it is mounted on onyx-like jet black plastic sub-base. List price is $50.00.

CODE PRACTICE SET You get a sure, smooth, Speed-X model 310-001 transmitting key, linear circuit oscillator and amplifier, with a built-in 2" speaker, all mounted on a heavy duty aluminum base with non-skid feet. Operates on standard 9V transistor type battery (not included). List price, $18.50.

PHONE PATCH Model No. 250-46-1 measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $36.50. Model 250-46-3, designed for use with transceivers having a built-in speaker, has its own built-in 2" x 6" 2 watt speaker. Measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $44.50.

Mosley



- Model TA-33
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

The Mosley TA-33, 3-element beam provides outstanding 10, 15 and 20 meter performance. Exceptionally broadband — gives excellent results over full Ham bandwidth. Incorporating Mosley Famous Trap-Master traps. Power Rating — 2KW P.E.P. SSB. The TA-33 may also be used on 40 meters with TA-40KR conversion. Complete with hardware. $198.15

MULTI-BAND BEAMS
TRAP MASTER 33 . . . 10, 15 & 20 Meters

- Model TA-33Jr.
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

The TA-33Jr . . . incorporates Mosley Trap-Master Junior traps. This is the low power brother of the TA-33. Power Rating — 1 KW P.E.P. SSB. $144.45

TA-33JR. POWER CONVERSION KIT MODEL MPK-3
Owners of the Mosley Trap-Master TA-33Jr. may obtain higher power without buying an entirely new antenna. The addition of the MPK-3 (power conversion kit) converts the TA-33Jr. into essentially a new antenna with 750 watts AM/CW and 2000 watts P.E.P. SSB. $49.65

TRAP MASTER 36 . . . 10, 15 & 20 Meters

- Model TA-36
- 6 Elements
- Forward Gain (over isotropic source) - 10.1 db on 15 & 20 meters, 11.1 db on 10 meters.

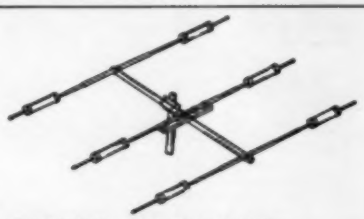
Front-to-Back Ratio on all bands. 20 db.
This wide-spaced, six element configuration employs 4 operating elements on 10 meters, 3 operating elements on 15 meters, and 3 operating elements on 20 meters. Automatic bandswitching is accomplished through Mosley exclusively designed high impedance parallel resonant "Trap Circuit." The TA-36 is designed for 1000 watts AM/CW or 2000 watts P.E.P. SSB. Traps are weather and dirt proof, offering frequency stability under all weather conditions. $328.35

MOSLEY AK-60 MAST PLATE ADAPTER
Mast Plate Adapter for adapting your Mosley 1½" mounted beam to fit 2" OD mast. Complete with angle and hardware. $9.85

NATIONAL RADIO COMPANY, INC.
NRCI

NCL-2000
Linear Amplifier. A full 10 Db gain. 20 watts in 2000 watts out. Can be driven with one watt. Continuous duty design utilizes two 8122 ceramic tetrode output tubes, designed for both AM and SSB operation. The industry standard for 12 years. Thousands in use all over the world. Price: $1,200

NCX-1000
The only 1000 watt, "single package" transceiver. Heavy duty design . . . results of 50 years of design leadership in amateur equipment. State of the art speech processing. linear amplifier, power supply, all in one package. Nothing extra to buy. Covers all amateur bands in HF spectrum . . . AM, SSB, CW. Price: $1,600



CLASSIC-33 . . . 10, 15 & 20 Meters
Model CL-33

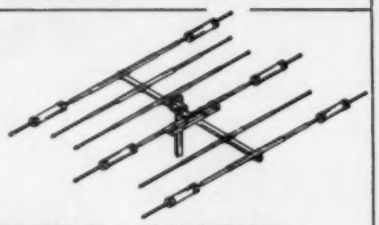
- 3 Elements
- 10.1 db Forward Gain (over isotropic source) on all bands.
- 20 db Front-to-Back Ratio on 15 & 20 meters, 15 db on 10 meters.

BRIDGING THE GAP . . . The Classic 33, combines the best of two Mosley systems. Incorporating Mosley Classic Feed System for a "Balanced Capacitive Matching" system with a feed point impedance of 52 ohms at resonance, and the Famous Mosley Trap-Master Traps for "weather-proof" traps with resonant frequency stability. This extra sturdy multi-band beam, Model CL-33, for operation on 10, 15 & 20 meters features improved boom to element clamping, stainless steel hardware, balanced radiation and a longer boom for even wider element spacing. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Wind Load — 120 lbs. at 80 MPH. Approx. shipping weight — 45 lbs. $223.90

CLASSIC-203 . . . 20 Meters
Model CL-203
3 Elements

- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

Incorporating the Mosley patented Classic Feed System, this full size 20 meter single-band beam has 1½" to 3/8" dia. "swaged" elements wide spaced on a 2" dia. 24' boom. Maximum element length-37' 8½". The high standards in quality construction established by Mosley in over a quarter-century of manufacturing is reflected in this mono-band . . . Model CL-203. Boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" System has a nominal feed point impedance of 52 Ohms at 2 KW P.E.P. SSB. Recommended mast size-2" O.D. Approx. shipping wt: 42 lbs. via truck. $227.65



CLASSIC-36 . . . 10, 15 & 20 Meters
Model CL-36

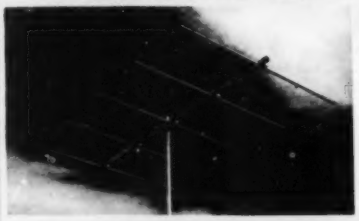
- 6 Elements
- 10.1 db Forward Gain (over isotropic source) on 15 & 20 meters, 11.1 db on 10 meters.
- 20 db Front-to-Back Ratio on all bands.

The Classic 36, like the smaller Classic 33, incorporates both the Mosley World-Famous Trap-Master Traps and the Mosley Classic Feed-System. Designed to operate on 10, 15 & 20 meters, this multi-band beam Model CL-36, employs the high standards of quality construction found in all Mosley products. The boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" system has a feed point impedance of 52 ohms at resonance. Wind Load — 210.1 lbs. at 80 MPH. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Approx. shipping weight — 71 lbs. via truck. $298.50

40 METER CONVERSION KIT MODEL TA-40KR
Work 40 meters in addition to 10, 15 & 20 meters by using a TA-40KR conversion kit on the radiator element of the TA-33 and TA-36. (Beams with broad band capacitive matching may not be converted!) Convert the TA-33Jr. with the MPK-3 (power conversion kit) before adding the TA-40KR kit. $88.45

SIGNAL-MASTER ANTENNA
Beam Antenna . . . Model S-402 for 40 meters
For a top signal needed to push through forty meter QRM, the Mosley Signal Master S-402 will do the trick! This 100% rust-proof 2-element beauty constructed of rugged heavy-wall aluminum is designed and engineered to provide the performance you need for both DX hunting and relaxing in a QRM free rag-chewing session. Beam is fed through link coupling, resulting in an excellent match over the entire bandwidth. $257.50

6 METER BEAMS



3 - 5 - 6 - 10 ELEMENTS

Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description	3 element	5 element	6 element	10 element
Model No.	A50-3	A50-5	A50-6	A50-10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	28 dB
Weight	7 lbs.	11 lbs.	18 lbs.	25 lbs.

new **RINGO RANGER** for **FM**

4.5 dB* — 6 dB**

Omnidirectional

GAIN

BASE STATION

ANTENNAS

FOR MAXIMUM PERFORMANCE AND VALUE

Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this exteade. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

ARX-2K CONVERSION KIT

2 METER ANTENNAS FM

A-FM RINGO 3.75 dB Gain (reference ¼ wave whip). Half wave length antenna with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install. 6 meter partly preassembled, all but 450 MHz take 1 ¼" mast. There are more Ringos in use than all other FM antennas combined.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-460
Power—Hdlg. Watts	100	200	100	100	250
Wind area sq. ft.	.21'	.21'	.21'	.20'	.16'

5-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 23' 230 MHz — 13', 435 MHz — 8', pattern 360° — 6 dB gain, 180° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting boom, harness and all hardware. Vertical support must not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.50 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.50 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.15 sq. ft.

8-POWER PACK The big signal (32 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 34 dB, ½ power beamwidth 43°, dimensions 144" x 80" x 40", turn radius 69", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-32 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

8-YAGI STACKING KITS VPK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 3 dB gain over the single antenna.

A14-VPK,	complete 4 element stacking kit
A14-SK,	4 element coax harness only
A147-VPK,	complete 11 element stacking kit
A147-SK,	11 element coax harness only
A440-SK,	6 + 11 element coax harness only

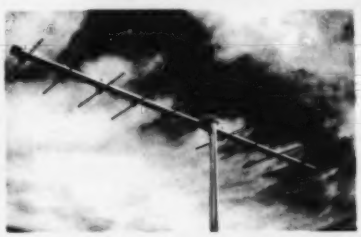
5-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-258 connectors.

Model Number	A147-11	A-147-4	A449-11	A449-6	A220-11
Boom/Longest ele.	144"/40"	44"/40"	80"/13"	26"/26"	102"/26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 69"	3 lbs., 18"	5 lbs., 51"
Gain/F/B ratio dB	13.2/28	9/30	13.2/28	11/25	13.2/28
½ Power beam	46°	86°	46°	69°	46°
Wind area sq. ft.	1.21	.45	.39	.30	.59
Frequency MHz	146-148	146-148	440-450	440-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 126", weight 10 lbs., longest element 40", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS



3/4, 1-1/4, 2 METER BEAMS

The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the astennas have 3/16" O. D. solid aluminum elements with 5/16" center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O.D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O.D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144-7	A144-11	A220-11	A430-11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Lngth.	96"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	28 dB	28 dB	28 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

VHF/UHF BEAMS

A50-3	$ 32.95	A144-7	21.95
A50-5	49.95	A144-11	32.95
A50-6	69.95	A430-11	24.95
A50-10	99.95		

AMATEUR FM ANTENNAS

A147-4	$ 19.95	AFM-44D	54.95
A147-11	29.95	AR-2	21.95
A147-20T	54.95	AR-6	32.95
A147-22	84.95	AR-25	29.95
A220-7	21.95	AR-220	21.95
A220-11	27.95	AR-450	21.95
A449-6	21.95	ARX-2	32.95
A449-11	27.95	ARX-2K	13.95
AFM-4D	59.95	ARX-220	32.95
AFM-24D	57.95	ARX-450	32.95

Description:	144 MHz. Model:	Price:	220 MHz. Model:	Price:	432 MHz. Model:	Price:
20 Element DX-Array	DX-120	42.95	DX-220	37.95	DX-420	32.95
Frame & Harness (40 ft.)	DXK-140	69.95	DXK-240	54.95	DXK-440	39.95
Frame & Harness (80 ft.)	DXK-180	109.95	DXK-280	85.95	DXK-480	79.95
1-1 52-ohm balun	DX-1BN	12.95	DX-2BN	12.95	DX-4BN	12.95
Vert. Pol. Bracket (30 ft.)	DX-VPB	9.95	DX-VPB	9.95	DX-VPB	9.95

TUFTS RADIO CATALOG — TUFTS RADIO

For all you hams with little cars ...

We've got the perfect mobile rig for you.

The Atlas 210x or 215x measures only 9½" wide x 9½" deep x only 3½" high, yet the above photograph shows how easily the Atlas transceiver fits into a compact car. And there's plenty of room to spare for VHF gear and other accessory equipment. With the exclusive Atlas plug-in design, you can slip your Atlas in and out of your car in a matter of seconds. All connections are made automatically.

BUT DON'T LET THE SMALL SIZE FOOL YOU!!
Even though the Atlas 210x and 215x transceivers are less than half the size and weight of other HF transceivers, The Atlas is truly a giant in performance.

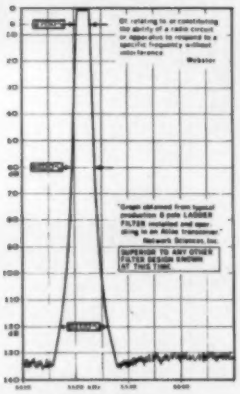
200 WATTS POWER RATING!
This power level in a seven pound transceiver is incredible but true. Atlas transceivers give you all the talk power you need to work the world barefoot. Signal reports constantly reflect great surprise at the signal strength in relation to the power rating.

FULL 5 BAND COVERAGE
The 210x covers 10-80 meters, while the 215x covers 15-160 meters. Adding the Atlas Model 10x Crystal Oscillator provides greatly increased frequency coverage for MARS and network operation.

NO TRANSMITTER TUNING OR LOADING CONTROLS
with Atlas' total broadbanding. With your Atlas you get instant QSY and band change.

MOST ADVANCED STATE OF THE ART SOLID STATE DESIGN
not only accounts for its light weight, but assures you years of top performance and trouble free operating pleasure.

PLUG-IN CIRCUIT BOARDS
and modular design provides for ease of servicing.


Bandwidth
Shape Factor
Skirt
Rejection
Webster
"Graph obtained from typical production 8 pole LADDER FILTER installed and operating in an Atlas transceiver"
Hayward, California
SUPERIOR TO ANY OTHER FILTER DESIGN KNOWN AT THIS TIME

PHENOMENAL SELECTIVITY
The exclusive 8 pole crystal ladder filter used in Atlas transceivers represents a major breakthrough in filter design, with unprecedented skirt selectivity and ultimate rejection. As the above graph shows, this filter provides a 6 db bandwidth of 2700 Hertz, 60 db down of only 4300 Hertz, and a bandwidth of only 9200 Hertz at 120 db down! Ultimate rejection is in excess of 130 db; greater than the measuring limits of most test equipment.

EXCEPTIONAL IMMUNITY TO STRONG SIGNAL OVERLOAD AND CROSS MODULATION. The exclusive front end design in the receiver allows you to operate closer in frequency to strong neighboring signals than you have ever experienced before. If you have not yet operated an Atlas transceiver in a crowded band and compared it with any other receiver or transceiver, you have a real thrill coming.

A WORLD WIDE DEALER NETWORK TO SERVE YOU.
Whether you're driving a Honda in Kansas City or a Mercedes Benz in West Germany, there's an Atlas dealer near you.

Atlas 210x or 215x	$675.00
W/Noise Blanker	719.00
ACCESSORIES:	
AC Console 110/220 V	147.00
Portable AC supply 110/220 V	100.00
Plug-in Mobile Kit	48.00
10x Osc. less crystals	59.00
Digital Dial DD-02	239.00

For complete details see your Atlas dealer, or drop us a card and we'll mail you a brochure with dealer list.

ATLAS RADIO INC.

mounts - leads - accessories

All resonators are precision wound with optimized design for each band. Assembly includes 17-7 PH stainless steel adjustable tip rod for lowest SWR and band edge marker. Choose for medium or high power operation.

STANDARD GAIN MOBILES

Two Meters

- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—200 watts FM

MODEL SBLT-144
47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $33.75

MODEL SBL-144
47" antenna mounts on any flat surface, roof, deck or fender in ⅜" hole. Includes impact spring, 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $31.65

HUSTLER "BUCK-BUSTER"

MODEL BF-2
51" two meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ⅜"-24 base to fit your mount or a wide selection of Hustler mobile mounts. (Mount or cable not included).
Price: $9.00

DELUXE MOBILE MOUNTS

For medium length, light weight antennas with ⅜"—24 base.

MODEL TLM
Trunk lip mount for no holes installation on side or edge of trunk lid. Includes 17' RG-58-U connectors attached.
Price: $14.85

MODEL MLM
Deluxe trunk lip mount with 180 degree swivel ball for positioning antenna to vertical. Easy — no holes — installation. Includes 17' RG-58-U cable and connectors attached.
Price: $17.20

MODEL GCM-1
Rain gutter mount fits all shapes, angles even latest trim line gutters. Includes 180° swivel ball.
Price: $9.00

MODEL MM-1
Cowl mount installs in 1" hole. Includes MB-1 swivel ball and SO-239 connectors.
Price: $7.50

MODEL TGM-1
Trunk groove mount installs in hidden area of groove under trunk lid. Mounting hardware included.
Price: $8.00

SUPER GAIN MOBILES

Two Meters

- 5.2 db gain over 1/4 wave mobile antenna
- Frequency coverage—143-149 MHz
- SWR at resonance—1.1:1 typical
- Power rating—200 watts FM

TWO AND SIX METERS—TRUNK LIP MOUNT
MODEL HFT
Four section telescopic antenna permits separate adjustment for simultaneous resonance on two and six meters. Operational height: 40". Complete with trunk lip mount, 17' MIL SPEC RG-58-U and factory attached PL-259.
Price: $22.55

VHF/UHF ANTENNA—ROOF MOUNT
MODEL UHT-1
Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ⅜" hole. Includes 15' RG-58-U.
Price: $9.95

RESONATOR SPRING—STAINLESS STEEL
MODEL RSS-2
Installs between Hustler mast and resonator. Absorbs shock when antenna strikes overhanging obstruction. Supplied ready for easy installation.
Price: $1.50

MODEL CST-144
Get big signal performance, superior receiving capability with this 65" collinear antenna. Easy installation on side or edge of trunk lip without drilling — complete with 17' MIL SPEC RG-58-U and PL-259.
Price: $41.30

MODEL CG-144
Same characteristics as CGT-144 supplied with ⅜"-24 base to fit all mobile ball mounts — Length is 65". Mount and cable not included.
Price: $25.50

VHF/UHF ANTENNA—TRUNK LIP MOUNT
MODEL THF
Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259.
Price: $10.50

STAINLESS STEEL BALL MOUNT FOR DECK, FENDER OR ANY FLAT SURFACE
MODEL SSM-2
Heavy 2" reinforced stainless steel base. Adjustable ball mount easily supports any amateur mobile antenna. Includes cylinder lock, steel back-up plate and mounting hardware.
Price: $19.20

QUICK DISCONNECT—100% STAINLESS STEEL
MODEL QD-1
Removes antenna from mount with easy press and twist release. Completely stainless steel and self locking, stainless steel, ⅜"-24 threads—female one end, male the other.
Price: $10.95

FEED LINE MODEL L-14-240
Our known performance, maximum strength line for resonant 240-ohm systems. RG-59/U type 20 length of RG-58-U cable. Includes connectors all attached for use with ball or bumper mount and transceiver.
Price: $6.95

MODEL GS-144A — Deluxe, Two Meter Colinear for Repeater or any fixed station operation. 6 db. gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator: ½ wave lower section, ½ wave phasing, ½ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¼" O.D. SO 239 coax connector.
Price: $67.50

MODEL C-22
Ball mount complete with mounting hardware.
Price: $8.20

STANDARD HUSTLER RESONATORS

Power Rating: 400 Watts SSB

Model	Band	Price
RM-10	10 meters	$ 6.50
RM-15	15 meters	6.95
RM-20	20 meters	7.30
RM-40	40 meters	13.20
RM-75	75 meters	15.50
RM-80	80 meters	15.95

SUPER HUSTLER RESONATORS

Power Rating: Legal Limit SSB
Supers have widest bandwidth

Model	Band	Price
RM-10S	10 meters	$11.30
RM-15S	15 meters	12.65
RM-20S	20 meters	13.00
RM-40S	40 meters	15.50
RM-75S	75 meters	30.00
RM-80S	80 meters	30.40

For 6-10-15-20-40-75-80 Meters

Fold over mast for quick and easy interchange of resonators or entering a garage. When operating, mast is held vertical with shakeproof sleeve clutch. 54" mast also serves as 1/4 wavelength 6 meter antenna. Stainless steel base has ⅜"-24 threads to fit mobile ball mount or bumper mount.

HUSTLER MASTS

The Majority Choice of Amateurs Throughout the World!

MODEL MS-2
For bumper mounting—Fold is at roof line 27" above base. **Price: $22.00**

MODEL MS-1
For deck or fender mounting—Fold is at roof line 15" above base. **Price: $22.00**

Covers 10 - 15 - 20 - 40 Meters
Only Hustler Gives One Setting for Whole Band Coverage

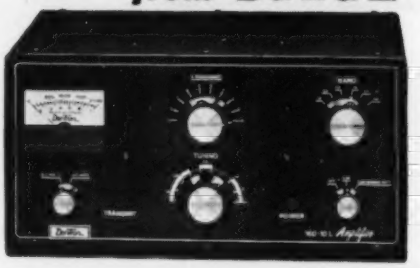
MODEL 4-STV

- Lowest SWR—PLUS.
- Bandwidth at its broadest! SWR 1.5 to 1 or better at band edges.
- Hustler exclusive trap covers "Sprite" extruded to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch fiberglass trap forms for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with low loss—high strength insulators. Mounting hardware included.
- All sections ¾" heavy wall, high strength aluminum.
- Stainless steel clamps permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be easiest assembly of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for 75 meter operation when desired.
- Top loading on 75 meters for broader bandwidth and higher radiation efficiency!
- Feed with any length 50 ohm coax.
- Power capability—full legal limit on SSB or CW.
- Mounting: Ground mount with or without radials, or roof mount with radials.

Length: 21' 3"
MODEL 4-STV
Weight: 15 lbs.
Price: $99.95

HUSTLER

SUPER AMP from DenTron



If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI shielding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4-8728's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all

$574.50

The 80-10 Skymatcher

Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- SO-239 receptional to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W. 5" H. 8" D., Weight: 5 lbs.

$59.50

Read forward and reflected watts at the same time

Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

Match everything from 160 to 10 with the new 160-10 MAT

NEW: The Monitor Tuner was designed because of overwhelming demand. Hams told us they wanted a 3 kilowatt tuner with a built-in wattmeter, a front panel antenna selector for coax, balanced line and random wire. So we engineered the 160-10m Monitor Tuner. It's a lifetime investment at $299.50.

$299.50

Meet the SuperTuner

The DenTron Super Tuner tunes everything from 160-10 meters. Whether you have balanced line, coax cable, random or long wire, the Super Tuner will match the antenna impedance to your transmitter. All DenTron tuners give you maximum power transfer from your transmitter to your antenna, and isn't that where it really counts?

1 KW MODEL **$129.50** 3 KW MODEL **$229.50**

The Sky Openers

SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one cleverly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and nested HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantastic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

$129.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	50
80	200
40	entire band

Tuning is easy and reliable. Rugged construction assures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds. Handles full legal power limit.

$79.50

ALL BAND DOUBLET

This All Band Doublet or inverted Type Antenna covers 160 thru 10 meters. Has total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 450 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

EX-1

The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

DenTron

DRAKE TVI FILTERS High Pass Filters for TV Sets

provide more than 40 dB attenuation at 52 MHz and lower. Protect the TV set from amateur transmitters 6-160 meters.

Drake TV-300-HP
Model No. 1603
For 300 ohm twin lead
Price: $10.60

DRAKE TV-5200-LP
200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.
Model No. 1609 Price: $26.60

Drake TV-75-HP
Model No. 1610
For 75 ohm TV coaxial cable; TV type connectors installed
Price: $13.25

DRAKE TV-3300-LP
1000 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems. Price: $26.60 Model No. 1608

LOW PASS FILTERS FOR TRANSMITTERS

have four pi sections for sharp cut off below channel 2, and to attenuate transmitter harmonics falling in any TV channel and fm band. 52 ohm. SO-239 connectors built in.

DRAKE TV-42-LP Model No. 1605
is a four section filter designed with 43.2 MHz cut-off and extremely high attenuation in all TV channels for transmitters operating at 30 MHz and lower. Rated 100 watts input. Price: $14.60

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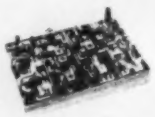
WORK ALL REPEATERS WITH OUR NEW SYNTHESIZER II

The Synthesizer II is a two meter frequency synthesizer. Frequency is adjustable in 5 kHz steps from 140.00 MHz to 149.995 MHz with its digital readout thumb wheel switching. Transmit offsets are digitally programmed on a diode matrix, and can range from 10 kHz to 10 MHz. No additional components are necessary!
Kit . . . . . $169.95 Wired and tested $239.95

RECEIVERS

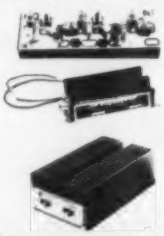


RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter . . .	$ 59.95
RX28C W/T . .	same as above—wired & tested . .	104.95
RX50C Kit . .	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX50C W/T .	same as above—wired & tested . .	104.95
RX144C Kit .	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T .	same as above—wired & tested . .	114.95
RX220C Kit .	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T .	same as above—wired & tested . .	114.95
RX432C Kit .	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RX432C W/T .	same as above—wired & tested . .	124.95

TRANSMITTERS

TX50	transmitter exciter, 1 watt, 6 mtr .	39.95
TX50 W/T . . .	same as above—wired & tested . .	59.95
TX144B Kit . .	transmitter exciter—1 watt—2 mtrs	29.95
TX144B W/T .	same as above—wired & tested. . .	49.95
TX220B Kit . .	transmitter exciter—1watt—220 MHz	29.95

POWER AMPLIFIERS



PA2501H Kit .	2 mtr power amp—kit 1w in—25w out with solid state switching, case, connectors	59.95
PA2501H W/T.	same as above—wired & tested . .	74.95
PA4010H Kit .	2 mtr power amp—10w in—40w out—relay switching	59.95
PA4010H W/T.	same as above—wired & tested . .	74.95
PA50/25 Kit .	6 mtr power amp, 1w in, 25w out, less case, connectors & switching .	49.95
PA50/25 W/T .	same as above, wired & tested. . .	69.95
PA144/15 Kit .	2 mtr power amp—1w in—15w out—less case, connectors and switching	39.95
PA144/25 Kit .	same as PA144/15 kit but 25w . .	49.95
PA220/15 Kit .	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit .	power amp—similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10 W/T	10w in—140w out—2 mtr amp . .	179.95
PA140/30 W/T	30w in—140w out—2 mtr amp . .	159.95

POWER SUPPLIES

PS15C Kit . . .	15 amp—12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection . .	79.95
PS15C W/T . .	same as above—wired & tested . .	94.95
PS25C Kit . . .	25 amp—12 volt regulated power supply w/case, w/fold-back current limiting and ovp	129.95
PS25C W/T . .	same as above—wired & tested . .	149.95
PS25M Kit. . .	same as PS25C with meters	149.95
PS25M W/T . .	same as above—wired & tested . .	169.95

REPEATERS

RPT50 Kit. . .	repeater—6 meter	465.95
RPT50	repeater—6 meter, wired & tested	695.95
RPT144 Kit . .	repeater—2 mtr—15w—complete (less crystals)	465.95
RPT220 Kit . .	repeater—220 MHz—15w—complete (less crystals)	465.95
RPT432 Kit . .	repeater—10 watt—432 MHz (less crystals)	515.95
RPT144 W/T .	repeater—15 watt—2 mtr	695.95
RPT220 W/T .	repeater—15 watt—220 MHz. . . .	695.95
RPT432 W/T .	repeater—10 watt—432 MHz. . . .	749.95
DPLA50	6 mtr close spaced duplexer	575.00

TRANSCEIVERS

TRX50 Kit . .	Complete 6 mtr FM transceiver kit, 20w out, 10 channel scan with case (less mike and crystals).	249.95
TRX144 Kit .	same as above, but 2 mtr & 15w out	219.95
TRX220 Kit .	same as above except for 220 MHz	219.95
TRX432 Kit .	same as above except 10 watt and 432MHz	254.95
TRC-1	transceiver case only	19.95
TRC-2	transceiver case and accessories . .	39.95

SYNTHESIZERS

SYN II Kit. . .	2 mtr synthesizer, transmitt offsets programmable from 100 KHz—10 MHz, (Mars offsets with optional adapters)	169.95
SYN II W/T . .	same as above—wired & tested . .	239.95
MO-1 Kit. . . .	Mars/cap offset optional	2.50
TO-1 Kit	18 MHz optional tripler	2.50

WALKIE-TALKIES

HT 144B Kit .	2 mtr, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex .	129.95
NICAD	battery pack, 12 VDC, ½ amp. . . .	29.95
BC12	battery charger for above	5.95
Rubber Duck .	2 mtr, with male BNC connector .	8.95

RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50
RF28 Kit . . .	10 mtr RF front end 10.7 MHz out	12.50
RF50 Kit . . .	6 mtr RF front end 10.7 MHz out	12.50
RF144D Kit. .	2 mtr RF front end 10.7 MHz out	17.50
RF220D Kit. .	220 MHz RF front end 10.7 MHz out	17.50
RF432 Kit. . .	432 MHz RF front end 10.7 MHz out	27.50
IF 10.7F Kit .	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit. . .	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TX220B W/T .	same as above—wired & tested . .	49.95
TX432B Kit . .	transmitter exciter 432 MHz . . .	39.95
TX432B W/T .	same as above—wired & tested . .	59.95
TX150 Kit. . .	300 milliwatt, 2 mtr transmitter .	19.95
TX150 W/T . .	same as above—wired & tested . .	29.95

Blue Line . . . RF power amp, wired & tested, emission—CW-FM-SSB/AM

Model	Frequency	Power Input	Power Output	
BLB 3/150	45- 55MHz	3W	150W	TBA
BLC 10/70	140-160MHz	10W	70W	139.95
BLC 2/70	140-160MHz	2W	70W	159.95
BLC 10/150	140-160MHz	10W	150W	259.95
BLC 30/150	140-160MHz	30W	150W	239.95
BLD 2/60	220-230MHz	2W	60W	159.95
BLD 10/60	220-230MHz	10W	60W	139.95
BLD 10/120	220-230MHz	10W	120W	259.95
BLE 10/40	420-470MHz	10W	40W	139.95
BLE 2/40	420-470MHz	2W	40W	159.95
BLE 30/80	420-470MHz	30W	80W	259.95
BLE 10/80	420-470MHz	10W	80W	289.95

O.V.P.	adds over voltage protection to your power supplies, 15 VDC max. . .	9.95
PS3A Kit . . .	12 volt—power supply regulator card with fold-back current limiting . . .	8.95
PS3012 W/T .	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/fold-back current limiting and overvoltage protection	239.95

DPLA144 . . .	2 mtr. 600 KHz spaced duplexer, wired and tuned to frequency . . .	379.95
DPLA220 . . .	220 MHz duplexer, wired and tuned to frequency	379.95
DPLA432 . . .	rack mount duplexer	319.95
DSC-U	double shielded duplexer cables with PL259 connectors (pr.) . . .	25.00
DSC-N	same as above with type N connectors (pr.)	25.00

OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/diode switching.	$ 6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD3 Kit	UHF version of CD1 deck, needed for 432 multi-channel operation.	12.95
COR2 Kit . . .	carrier operated relay.	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each). . .	5.00
CWID Kit . . .	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed .	59.95
MIC 1	2,000 ohm dynamic mike with P.T.T. and coil cord	12.95
TS1 W/T	tone squelch decoder.	59.95
TS1 W/T	installed in repeater, including interface accessories	89.95
TD3 Kit	2 tone decoder	29.95
TD3 W/T	same as above—wired & tested .	39.95
HL144 W/T . .	4 pole helical resonator, wired & tested, swept tuned to 144 MHz ban . .	24.95
HL220 W/T . .	same as above tuned to 220 MHz ban	24.95
HL432 W/T . .	same as above tuned to 432 MHz ban	24.95

Vhf engineering
THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

TUF'TS RADIO CATALOG TUF'TS RADIO

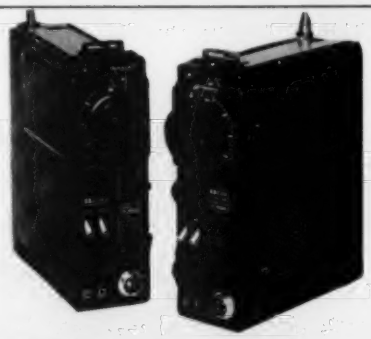
Now It's Crystal Clear

Yes, now ICOM helps you steer clear of all the hassles of channel crystals. The new **IC-22S** is the same surprising radio you've come to know and love as the **IC-22A**, except that it is totally crystal independent. **Zero crystals.** Solid state engineering enables you to program 23 channels of your choice without waiting. Now the ICOM performance you've demanded comes with the convenience you've wanted, with your new **IC-22S.**

Price: $299.00

IC-245 Transceiver
The VFO Revolution goes mobile with the unique, ICOM developed LSI synthesizer with 4 digit LED readout. The IC-245 offers the most for mobile on the market. The easy to use tuning knob moves accurately over 50 detent steps and assures excellent control as easily as steering the vehicle. With its optional adapter, the IC-245 puts you into all mode operation on 12V DC power with a compact dash-mounted transceiver. In FM, the synthesizer command frequency is displayed in 5 kHz steps from 146 to 148 MHz, and with the side band adapter the step rate drops to 100 Hz from 144 to 146 MHz. For maximum repeater flexibility, the transmit and receive frequencies are independently programmable on any separation. The IC-245 even comes equipped with a multiple pin Molex connector for remote control. The IC-245 is a product of the revolution in VFO design, from its new style front panel, to its excellent mechanical rigidity and Large Scale Integrated Circuitry. Your IC-245 will give you the most for mobile. $499.00

THE NEW ICOM 4 MEG, MULTI-MODE, 2 METER RADIO — IC 211
ICOM introduces the first of a great new wave of amateur radios, with new styling, new versatility, new integration of functions. You've never before laid eyes on a radio like the IC-211, but you'll recognize what you've got when you first turn the single-knob frequency control on this compact new model. The IC-211 is fully synthesized in 100 Hz or 5 kHz steps, with dual tracking, optically coupled VFOs displayed by seven-segment LED readouts, providing any split. The IC-211 rolls through 4 megahertz as easily as a breaker through the surf. With its unique ICOM developed LSI synthesizer, the IC-211 is now the best "do everything" radio for 2 meters, with FM, USB, LSB and CW operation. $749.00



Hold it!

Take hold of SSB with these two low cost twins. ICOM'S new portable **IC-202** and **IC-502** put it within your reach wherever you are. You can take it with you to the hill top, the highways, or the beach. Three portable watts PEP on two meters or six!

Hello, DX! The ICOM quality and excellent receiver characteristics of this pair make bulky converters and low band rigs unnecessary for getting started in SSB-VHF. You just add your linear amp, if you wish, connect to the antenna, and DX! With the **202** you may talk through OSCAR VI and VII! Even transceive with an "up" receiving converter! The **IC-502,** similarly, makes use of six meters in ways that you would have always liked but could never have before. In fact, there are so many things to try, it's like opening a new band.

Take hold of Single Side Band. Take hold of some excitement. Take two.

IC-202
2 Meter SSB • 3 Watts PEP • True IF Noise Blanker Switched Dual Lights • Internal Batteries • 200KHz VXO Tuning • 144.0, 144.2 + 2 Mems* • RIT!
Price: $259.00

IC-502
6 Meter SSB • 3 Watts PEP • True IF Noise Blanker Switched Dual Lights • Internal Batteries • 500KHz VFO • RIT!
Price: $249.00

Now ICOM introduces 15 Channels of FM to Go!

The New IC-215: the FM Grabber

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, and ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really portable, while accessible features make conversion to external power and antenna fast and easy.

Grab for flexibility with the new **IC-215** FM portable.

- Front mounted controls and top mounted antenna
- Narrow filter (15KHz — compatible spacing)
- 15 channels (12 on dial / 3 priority)
- Fully collapsible antenna
- Compatible mount feature for flexible position
- Dual power (3 watts high / 400 mw low, nominal)
- External power and antenna easily accessible
- Lighted dial and meter

Price: $279.00

Your new IC-215 comes supplied with: 5 popular channels; handheld mic, with protective case; shoulder strap; connectors for external power and speaker; 9 long-life C batteries.

ICOM

TUFTS RADIO CATALOG TUFTS RADIO

Allan S. Joffe W3KBM
1005 Twining Road
Dresher PA 19025

Fight Inflation!

Build It Yourself!

-- tips on planning construction projects

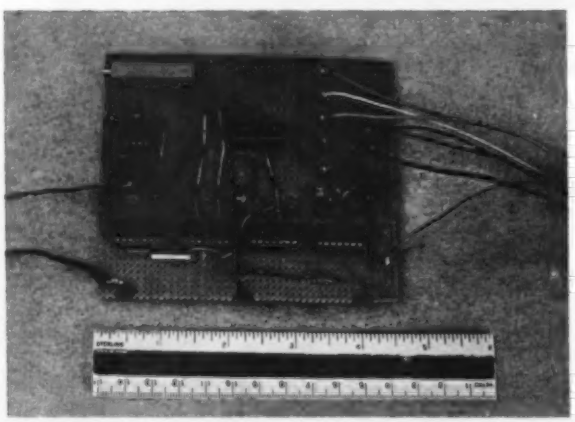
One of the lesser mysteries of hamdom is what makes one ham an operator and another a builder. At one time I monitored an active repeater, trying to sort out from the conversations who might be the operators and who might be the builders. Subsequent eyeball contacts did not confirm my deductions.

The builders were randomly distributed among the talkers, so the next question was, "Why are there not more builders on the scene?" Certainly there is the small parts shortage, for transmitter projects in particular. There also exists the "mail order lag," which can be discouraging, and finally there is to some degree the "stone wall of solid state." This exists to a degree amongst those of us who cut our teeth on vacuum tubes and still think of the collector as the plate (this includes me).

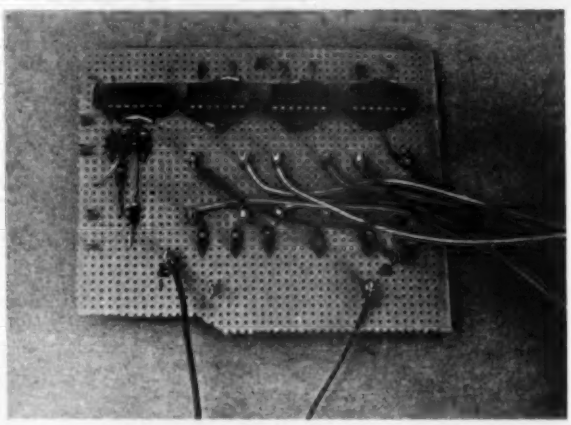
There is certainly no dearth of good construction articles, particularly in *73*, for both the beginner and the old-timer, although I must admit that if I were starting a ham career today, I might be a bit hard put to tackle some of the most interesting construction articles. With this little bit of soul searching out of the way, I decided to examine closely my mode of attack when I found a construction article of interest.

The March, 1976, issue of *73* carried an excellent article by Louis Hutton K7YZZ (page 76) entitled "Build this Exciting New TVT." My basic interest was in Part One, which described an electronic

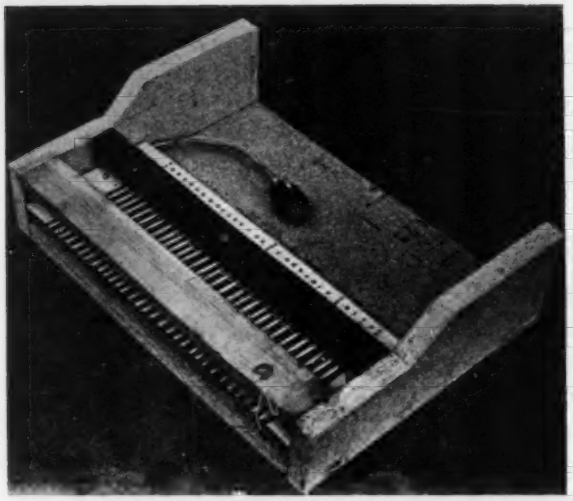
Photos by Ira Joffe WA3PTC.



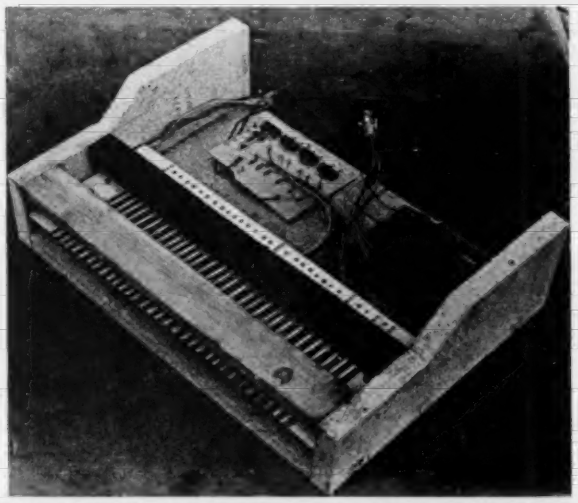
Board which includes timing generator. Trimpot in lower right hand corner is set to 90 Hz for 60 words per minute RTTY machine.



Memory board.



Basic shell with matrix laid in to show position.



Basic shell with all three electronics packages roughly placed.

keyboard that would run the RTTY printer with which I had been gifted.

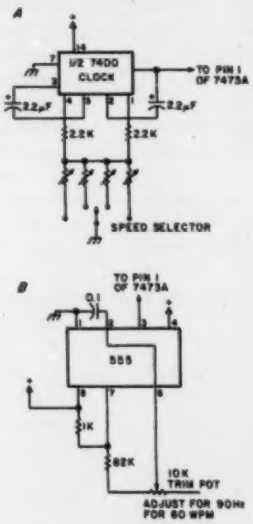
What decided me to build the keyboard unit was need, plus the fact that anything with so large an object as a keyboard attached did not have to be micro. This is a large consideration to us who are of bifocal bearing age.

In any multi IC project, there is always this decision: Should you make it up on one big board or separate the circuit into logical chunks that can then be connected together? I always stay awav from the "big chunk" theory and try to make the small boards plug together with connectors for ease of troubleshooting.

Most projects somewhere along the line will display the personal foibles and beliefs of first the originator and then the duplicator. Lou had formatted his clock oscillator using a 7400 NAND gate with 2.2 uF capacitors as part of the frequency determining elements. I have a personal hang-up about using such capacitors if there is a way to use a more stable animal such as a mylar or polystyrene unit. I also happen to like the 555 chip for purposes of this kind. Fig. 1 shows the original oscillator and my final version. I further added to the detour from the original article by not adding the switch selected keyboard speed arrangement.

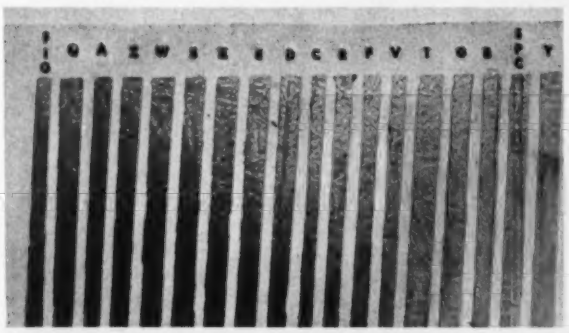
The same capacitor hang-up made me change the configuration of his reset generator. I used the same chip, a 74121 single shot multivibrator, but changed the configuration slightly to avoid use of electrolytics to determine the pulse output. Everything that I have read leads me to believe that this was a reasonable change for the better. Fig. 2 shows the original circuit and my modification.

Fig. 1. (a) Original oscillator circuit. (b) Author's revised circuit.



Lou's article also showed an end of the line counter, which is a great convenience. I omitted this, as I had rigged up a micro switch actuated by carriage movement which dings a bell at me when the last five spaces on a line come into view.

These compromises and adjustments gave me the contents of my first board, namely a 555 for the clock oscillator, two 7473 flip-flop packages, the 74121 single shot, the 74151 data selector chip, and one 7400 NAND gate package. This total of six chips was put on a 4 inch by 5 inch piece of perfboard.



Partial shot of matrix board after *etching and adding identification.*

Matrix board masked out prior *to etching.*

Fig. 2. (a) Original reset generator circuit. (b) Author's revised circuit.

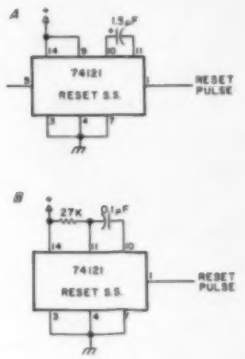
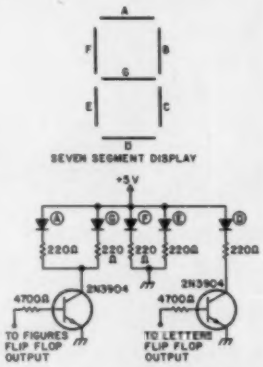


Fig. 3. Letters/figures indicator. Common anode MAN 64 7 segment 0.6" LED readout. Source: S.D. Sales.



The companion board merely had four 7400 NAND gate packages on it, these serving as basic memory capacity and letters/figures indicator control functions.

Now we have cut the project down to size by some analysis, elimination, and expression of our personal tastes and opinions. Perhaps if this exercise in technical democracy was practiced more often, those of you who now hesitate to build might do so more frequently.

The single large piece of electrical work left was to create the diode matrix which forms the various character combinations. Again, since the finished product is going to be about the size of a portable typewriter (without encountering scorn), there was no reason to go micro in any way with the matrix. A piece of circuit board 5 inches by 13 inches (copper on one side) was coated with resist. Some 32 circuit stripes were cut into the board running parallel to the five inch dimension. You only need 31 of these stripes, but I always give a bit extra just in case something goes wrong in the etching or the drilling. This is not chicken, but very practical, as disenchantment with one's own etched boards can also turn off the would-be builder.

A finely laid out, closely spaced PC board can give you fits, but an item like this matrix board is just so macro that it can't be a stumbling block. The etching process is self-minding, and the only turnoff here is if you use ferric chloride and get it on you or your clothes. It does not take Perry Mason to spot a careless user of ferric chloride. If you like speedy etching, you borrow the family aquarium pump and allow the airstone to bubble through the etchant while it is working. If you value your fish, use this airstone for etching only! The whole process is so simple that if PC etching was your excuse for not building, that excuse has now vanished.

Sure, you have put all the electronics together; you have even located a suitable keyboard. James Electronics supplied mine and it fulfilled the important requirement that each key have uncommitted contacts that were easy to solder to. When my keyboard arrived, it took the eagle eye of one of my harmonics to spot the fact that where there should have been a "Q", there was instead an "E". A letter to James brought speedy relief for this little problem, which is one of the many reasons that they are a favorite source for me.

Naturally, you know that the TTL chips use five volts and that a power supply was constructed, but I am not going to bore you with that fundamental other than to say it used a 309K regulator as a matter of good practice.

Now we get down to an emotional problem that we have all encountered. It can be spelled out in one great big word . . . packaging.

This is where the companies that make commercial gear have it over all but the most talented of us. We can put the electronics together, make it work, fix it . . . all those good fundamental things . . . but the finished product sitting in its ho hum housing looks less than aesthetic.

As you can see from the photographs, the bare skeleton foundation is made up of particle board ends, a masonite bottom, and some imagination as to what fitting final shape might be desired. The exact dimensions used are shown in the sketch. Sheet vinyl, a white background speckled with gold splashes, was purchased at the local variety store. Masonite panels were cut to fit the various areas and each panel was carefully covered with the vinyl sheeting using ordinary white glue as the adhesive. The main foundation unit was given similar

The keyboard with the RTTY machine that it serves.

cosmetic treatment. The matrix was mounted in place, as was the keyboard, and the wiring from keyboard to matrix was installed. Care was taken in two areas of this wiring: first, that all wires between matrix and keyboard were long enough to completely remove the matrix without disturbing the keyboard, if and when work might have to be done on the matrix; and secondly, the wire used in this operation was the most flexible stranded wire I could get to avoid putting any strain on the small solder tabs on the keyboard.

The balance of the electronics was installed inside the case, and since the unit is so relatively large in relation to the size of the total electronics packages, space was no problem. The entire power supply was built up on the rear panel of the unit. As you can see from the photo of the finished product, not only was the execution of the electronics passably done, but the finished total package is not something to bring funny looks from the uninitiated.

There is one final bit of show biz that I added to the electronics package. In Lou's original version, there are two LEDs which show the keyboard mode, namely letters or figures. I added the circuit shown in Fig. 3.

Basically, it is a seven segment LED display that shows an "F" when in the figures mode and an "L" for the letters mode. This is both an operating convenience and a bit of pizzazz for the visitor to the shack, who often is more taken with the blinking lights than the actual fact that you can communicate.

To sum it all up: Search out your projects on the basis of need, throw in pocketbook practicality, analyze the unit to see how you can go modular for ease of construction and eventual troubleshooting, and don't forget that an aesthetic package is a valuable detail that is within your abilities. Put them all together and you will find yourself entering the ranks of the builders and enjoying the results. ■

Finished keyboard. Black rectangle in upper right hand corner of small slanted panel is the LED figures/letter indicator. Note that some of the keyboard characters graphics such as the # sign had to be added so they appear on their own key. Also note that, as with most of these keyboards, most of the keys, particularly the numbers row, had upper case symbols above the numbers. They were blacked out with the aid of a resist pen. This accounts for the clean uncluttered look of the keys.

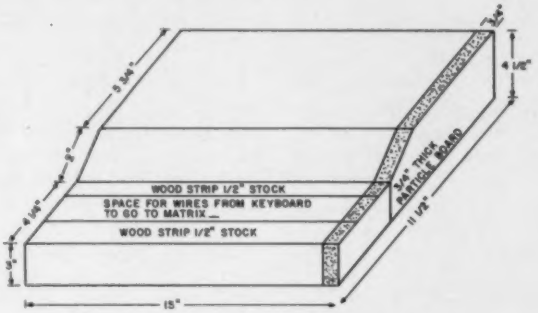


Fig. 4. RTTY keyboard case dimensions.

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In 1972 I got bitten by the two meter FM bug and bought one of the first Genave GTX-2 transceivers in the Washington DC area. I was most impressed with its ten push-button channels and 1 Watt/25 Watt power capabilities for local repeater and simplex operation. Only later did I discover the rig was lacking in adjacent channel selectivity, which only became a problem when I was trying to work 94 simplex within ten miles of our local 91 repeater.

At any rate, I secured the new rig under the dash of my VW with a pair of hinges with padlock hasps and two stout padlocks to discourage would-be ripoff artists. I used this arrangement for four years very successfully and even survived one break-in attempt while the car was parked on the street near my office. At this time, I decided that a less visible and conspicuous mobile installation was needed. Besides, there had been numerous occasions when I could have used a portable rig to help out with local traffic from remote locations during boat races, hamfests, and so on.

The GTX-2 is now a base station, and I have a new portable/mobile setup which I consider to be just about the best of all possible arrangements. The rig is a Wilson 1402 handie-talkie that goes with me, mobile and portable.

In the VW I have a 5/8 whip mounted in front of the windshield (total coax length, two feet!) which goes to a 25 Watt amplifier in the trunk. The cable from the amplifier feeds into the glove box of the VW which is the home of the Wilson when I'm in the car. An external power cable and a home brew speaker-mike/touchtone pad complete the mobile installation.

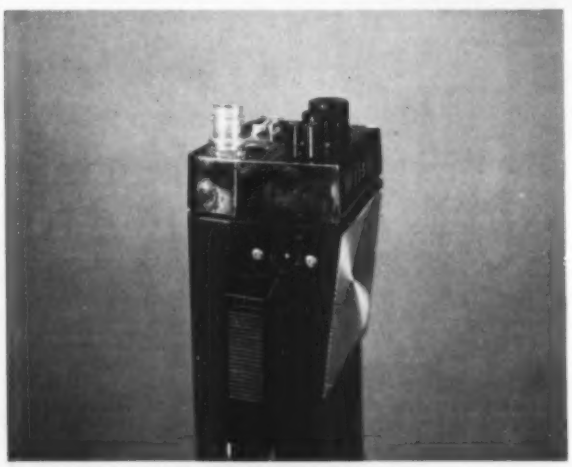

Fig. 1. BNC connector and external power jack.

The first (and most difficult) step in setting the Wilson up for mobile operation is to replace the TNC or F connector supplied with the rig with a BNC bulkhead connector. This is so you can quickly and easily remove the rubber ducky antenna and connect the mobile antenna.

I think it took me about a week, after I first looked at the inside of the Wilson, to get up enough nerve to tackle the job. Virtually everything must be disassembled to get to the antenna connector, and I am known to have all thumbs on both my hands when it comes to working on small things in tight places. At long last I undertook the job, and surprisingly enough everything went very well and without mishap. I unsoldered the leads from the original connector and removed it from the panel. The hex-shaped flange on the bottom of the original connector had been filed by the factory assemblers to fit the small space available, so I traced the outline of the flange on a 3/8-32 nut and ground it to the same shape. I threaded a second 3/8-32 nut tight up onto the new BNC panel connector. This nut would later be run down from the outside to tighten the connector to the panel of the Wilson. The D-shaped hole in the panel was reamed out with a 3/8" drill so the BNC connector could be screwed into the ground-off nut on the inside of the panel.

Everything went just as planned, and while I had the unit apart to install the antenna connector, I decided I might as well install a jack to power the rig from the car's electrical system. There appeared to be lots of room just above the push-to-talk button on the side for such a jack. I bought one of those Japanese connectors sold by Radio Shack and Lafayette for just such purposes. I also picked up a package that had a pair of mating plugs for the jack. I learned later that the two plugs were not the same kind, but found how to use

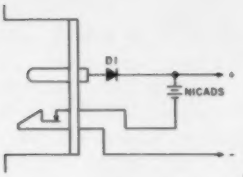

Fig. 2. Power connections.

both to good advantage, as I'll explain.

Fig. 1 shows the newly installed BNC connector and the external power connector jack. If you look closely, you can see the 3/8-32 nut that tightens the BNC connector to the panel. To drill the holes for the power connector, I used a hand-held drill bit to slowly drill the three holes. You don't get much torque or speed this way, but you can drill very clean holes in the plastic. If you try to use an electric drill, even a variable speed type, you'll probably end up scratching, gouging, or melting the plastic case.

Fig. 2 shows in a combined pictorial-schematic representation the connections of the external power jack. D1 is a junk box silicon rectifier and was installed for two reasons: first, to prevent damage to the rig by hooking up the external power source backwards; and second, to give a 0.7 volt drop to the nominal 13.6 volts supplied by the car's electrical system since the Wilson normally operates from 12.0 volts.

When I started to wire up the plug for this connector, I discovered that the two plugs I had bought were not the same type, although at first they appeared to be identical. They were both the same length and outside diameter, but the sizes of the holes in the center were quite different. The jack I had bought had a small diameter pin in the center which fit one of the plugs perfectly. This one I used to supply power from the car, since it would disconnect the nicads in the Wilson.

I made a happy discovery regarding the second plug, which had a much larger diameter hole in the center and fit the jack sloppily. Because of the loose fit of the plug on the center pin of the jack, when this plug was inserted into the jack the nicads were not disconnected, yet an electrical connection was made to both jack connections and thus to the nicads. Thus, by using this ill-fitting plug, I could parallel the nicads in the Wilson with an external power source for charging purposes. This is exactly what I did since I had not bought the Wilson charger. Now charging the nicads is ever so much simpler and handier than with my previous jury-rig of nails and clip leads.

The modified Wilson works beautifully as a mobile rig. It lives in the glove box, and the speaker-mike goes on the dash, right over the broadcast radio. At this point, the only problem I had was that I needed to fit a BNC connector on the Wilson rubber ducky antenna or I had to buy a new one with a BNC connector. The latter did not appeal to my Scotch nature, so I started looking for an F-to-BNC adapter. When I did finally locate one, I found that it cost almost as much as a new antenna and would also add about two inches to the already long antenna. Back to the drawing board.

It was about this time that a friend, WB3AXR, noticed that the internal threads at the rear of the BNC connector just happened to be 3/8-32. This meant that if the mutilated hex flange of the original Wilson F connector were ground completely off or otherwise removed, the connector would screw right down into the standard UG88/U BNC connector. Fantastic! Jim also happens to have a lathe and volunteered to perform the required surgery, although it could have been done with a file or a grinder almost as easily.

Fig. 3 shows the assembly, while Fig. 4 shows the adapter installed on the Wilson rubber ducky. The 3/8-32 nut is put on to lock the F connector to the BNC housing. All in all, a very nice compact adapter at very little cost. Thanks, Jim.

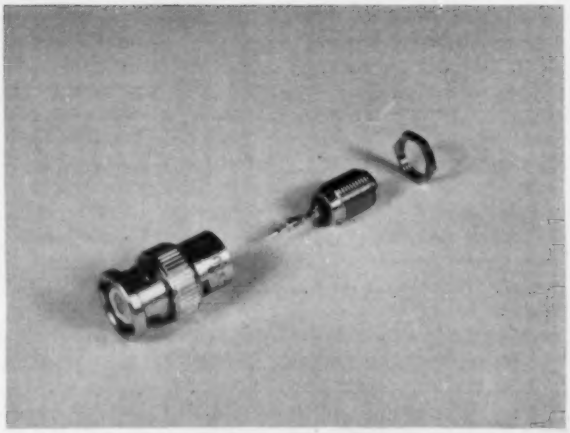

Fig. 3. Construction of the F-to-BNC adapter.

Incidentally, WB3AXR also has a Wilson 1402 and he too hesitated before tackling the job of changing the bulkhead antenna connector, despite his proven mechanical abilities and skills. However, when he saw that I, with my all-thumbs hands, had done it without mishap, he too made the conversion successfully.

The next thing I did to the rig cost me some money. The leather case of the Wilson is very well made, and does a great job of protecting the rig from scrapes and bumps, but it is very inconvenient when it comes to putting the rig on a trousers belt. One has to practically disrobe to thread the belt through the built-in belt loop on the back of the case. I took the case to a local leather goods shop and for two dollars had two male snaps installed as shown in Fig. 5. They do not interfere with the normal closing of the flap, and certainly make it handy for snapping the rig on a belt.

As indicated earlier, there is one more feature that was added to make a truly complete mobile/portable rig. This is a home brew speaker-mike/touchtone pad. I had bought the Wilson speaker-mike, and found it very useful in mobile operation.

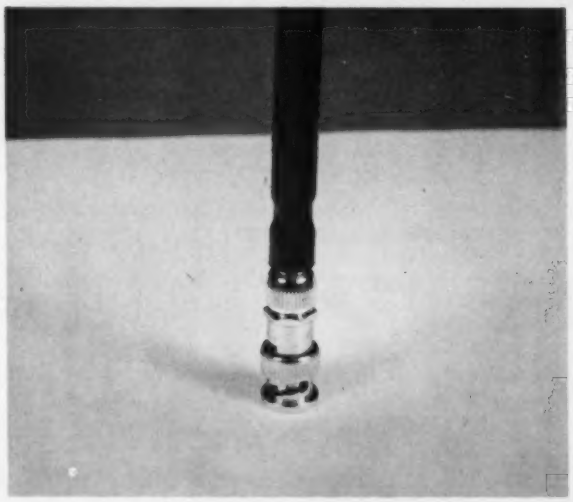

Fig. 4. Finished F-to-BNC adapter.

Fig. 5. Added snaps on the leather case.

Adding a touchtone pad to the rig, however, posed several problems. If I built the pad into the front of the transceiver case, it would not be convenient to use in the car. A couple of friends had modified the Wilson speaker-mike to include the touchtone pad on its rear. This method, unfortunately, involves a great deal of surgery on the speaker-mike case as well as a lot of delicate wiring and lots of epoxy to hold the thing together. The end result is very nice, but I'm quite sure I would blow it. Besides, I didn't like the idea of losing the molded mike hanger button on the back of the speaker-mike.

For these and other reasons, I decided to roll my own. I looked around for a suitable enclosure to house the parts, but found that most metal boxes (miniboxes and the like) were just not the right size and shape for the job. Then my roving eye landed on a small transistor radio that I had thrown in the junk box to "fix someday." I think I had paid $2.50 for it at a special sale and it would provide a loudspeaker and battery as well as a hand-size enclosure for the home brew speaker-mike. Not bad!

I had bought the 16 button touchtone keyboard kit of parts from Data Signal* some time ago and, because of my proposed custom design, I had not put the thing together yet. Indeed, I had ultimately decided that I would use the parts but not the circuit board in my custom installation, so it was quite fortuitous that I hadn't put it together. A quick eyeball measurement showed that everything should fit very nicely in the radio case, so I decided to go ahead with my plan.

The first step was to remove the radio circuit board and trace its outline on a piece of paper. The paper pattern was then used to cut out a piece of perfboard (holes on 0.1" centers) to replace the radio circuit board. I used perfboard because it makes no sense to make a printed circuit board for a custom one-of-a-kind project. More time would have been spent laying out the circuit on paper than was needed to complete the point-to-point wiring! I did use IC sockets, however, since soldering multiple leads to IC pins can be harmful to their health – a dead IC in such a situation can quickly cool off enthusiasm for the project.

Fig. 6 shows the final results from the outside. The switch on the right side is an on-off switch that is not at present in use. It was used in the original version only. The small white button near my thumb in Fig. 6(a) is the push-to-talk switch, a microswitch epoxied to the perfboard and extending through the original volume control opening in the case. The microphone, which I bought from Wilson, is located behind a series of small holes drilled in the vertical louvres, about a half inch from the push-to-talk button. The mike is sandwiched between the perfboard and the front of the case, held in place and cushioned by a thin sheet of foam rubber. The cord to the rig exits the unit through the original tuning capacitor opening in the right side of the case. Although the cord looks like a piece of lamp cord, it is actually stereo cable with a vinyl jacket and has two separate shielded cables. The cable is firmly anchored to the perfboard just inside the opening to prevent yanking out the wiring accidentally.

Fig. 6(b) shows the 16 button pad mounted on the back cover of the case. To get a template for drilling the mounting holes for the pad, I used the paper trick again. This time I actually pressed a piece of paper up against the back of the pad to transfer an impression of the four mounting pins and the nine terminal pins to the paper.

*Data Signal, Inc., 2212 Palmyra Road, Albany GA 31701.

A

Fig. 6. Front (a) and rear (b) views of the speaker-mike/pad.

B

The paper is then rubber cemented to the case while drilling the holes.

Not visible in Fig. 6 is a small hole drilled in the top end of the case for access to the output level control. The output is adjustable from zero to about 900 mV, which should easily drive any medium to high impedance mike circuit.

Fig. 7 is the diagram of the circuitry inside the case. As indicated earlier, the on-off switch was eliminated after the photos were taken. Standby drain is only 20 uA, changing to 4 mA when the circuit is activated by pressing any of the pad keys. The 100k Ohm resistor across the PNP switch transistor, Q2, supplies the standby current to the circuit. When any key is pressed, the 20 uA current is transferred to the common terminal of the pad and to the base of Q1, turning Q2 on to power the circuit.

The four gates of the CD4001 IC form a retriggerable monostable to key the transmitter via Q4. The monostable also drives Q3 to keep power on to the circuit at the same time. The 220k Ohm resistor and 10 uF capacitor determine the shut-off delay of the monostable. As shown, they provide about a half second delay when a pad key is released. For a longer delay (if you're a slow dialer!), increase either value – the resistor is easiest.

S1 is the push-to-talk switch and parallels Q4. Notice that the "shield" of the speaker lead is the push-to-talk line and is grounded only by Q4 or S1. The shield of the microphone lead is the only "ground" in the circuit.

And there you have it – the "compleat portable/mobile Wilson." Now if I could only fit a CMOS synthesizer in there some way . . . ■

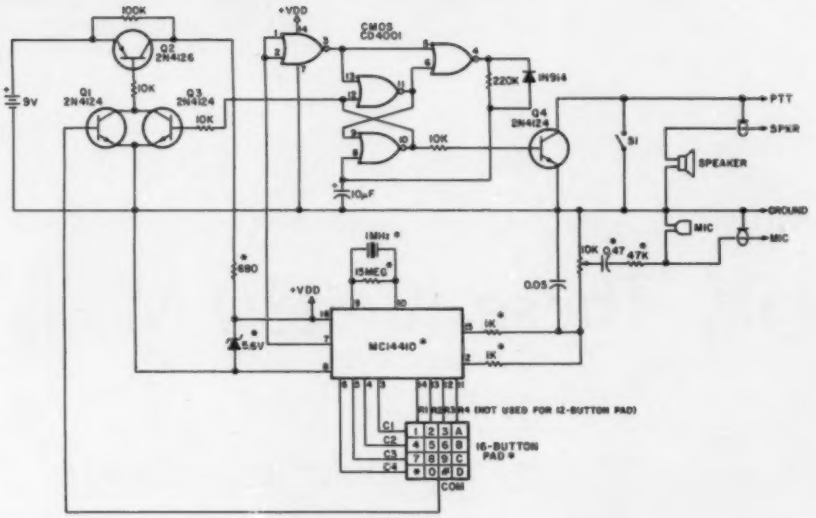

Fig. 7. Schematic of the speaker-mike/pad.

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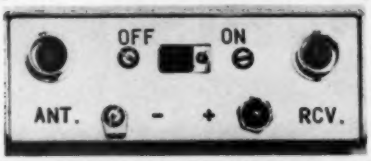

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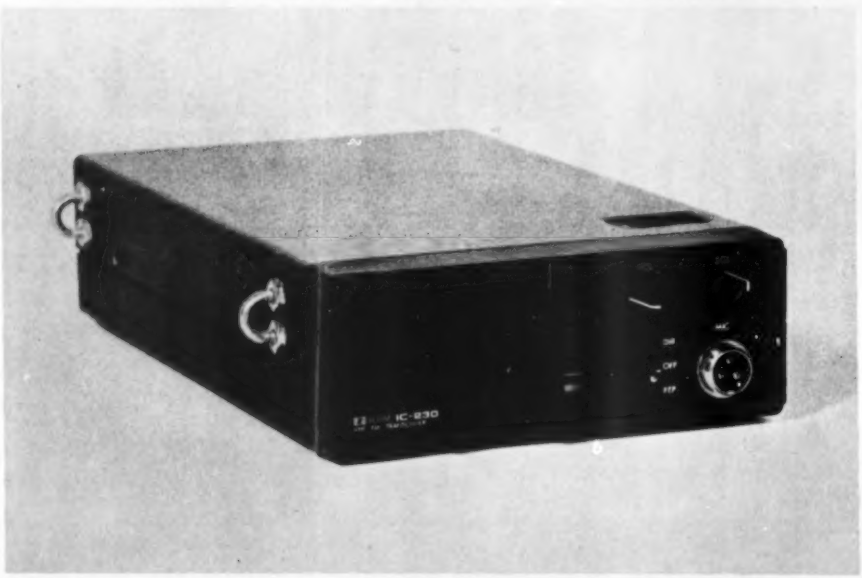
Try These IC-230 Mods

- - improving a popular transceiver

The Icom IC-230 appears to be one of the more popular synthesized two meter rigs on the market today. In its stock form, it tunes from 146.01 MHz to 147.99 MHz in 30 kHz steps, selectable by a 146-147 MHz push-button switch, and rotary switches for the 100 kHz and 10 kHz segments. The power switch is used to select either "direct" or "repeater" operation, and an additional slide switch on top of the rig sets the transmitter to the standard repeater offsets of 600 kHz above or below the selected receive frequency.

Numerous modifications may be applied to the IC-230 to further improve its versatility. This article explains the engineering and construction of 1) an inexpensive method of adding all "split" repeater and simplex frequencies, with easy selection and display; 2) a method for providing automatic repeater offset and simplex operation, so the user need only dial the receiver frequency on the front panel; 3) the utilization of a spare crystal socket, with trimmer, already in the rig, to provide for an additional non-standard repeater offset frequency; and 4) a high/low power switch, with variable low power from about 1/2 Watt upward. In addition, when the switch is in the low position, all front panel lights except the meter light are extinguished, to preserve battery life during portable operation.

All of these modifications are independent of each other, so any or all may be incorporated as desired.



Front view of the IC-230, showing location of the "normal-split" frequency switch. Moving the toggle to the right increases the frequency shown on the front panel by 15 kHz.

15 kHz Step Capability

This modification incorporates an added front panel switch which raises the frequency dialed by 15 kHz. This method covers all split channels between 146 and 148 MHz, and is cheaper and easier to use than adding extra crystals into the "A", "B", and "C" positions of the 100 and 10 kHz crystal bank.

Before going into the procedure for adding the split frequencies to the rig, a brief explanation of the synthesizer is in order (Fig. 1). The heart of the synthesizer is a voltage controlled oscillator (VCO). A crystal-controlled local oscillator (LO) generates a frequency which is determined by the position of the 100 kHz rotary switch. The LO frequency is multiplied by nine and subtracted from the VCO frequency. The resultant is phase compared to the control oscillator (CO) frequency, which is also crystal-generated and determined by the position of the 10 kHz switch. The phase comparator applies an error voltage to the VCO, which remains locked to the desired receive frequency minus the first i-f of 10.7 MHz. The proper transmit frequency is generated by a third crystal oscillator and mixer, which adds to the VCO output 10.7 MHz for simplex operation, 10.1 MHz for a -600 kHz transmit offset, or 11.3 MHz for a +600 kHz transmit offset.

This system has an interesting advantage: All transmit and receive frequencies are independent of possible spurious outputs in the LO and CO, since these are merely control circuits for the VCO.

Circuit Description

Note: Throughout this article, all components added to the IC-230 are given three-digit identifier numbers. Other components originally in the rig are identified in the

same manner as they appear in the IC-230 schematic.

Figs. 2 and 3 show the circuit used to obtain 15 kHz step capability. Each crystal in the LO may be set exactly on frequency by a trimmer capacitor located near the crystal. However, when capacitor C111 is switched in series with one of the crystals, its frequency is raised by about 1.7 kHz, or 15 kHz at its ninth multiple. Capacitor C110 is necessary to swamp out additional capacitance to ground obtained from the added wiring. Otherwise, the range of each crystal trimmer is exceeded before bringing the crystal back on frequency, after these components are added.

Since C111 affects each LO crystal differently, it is probable that a frequency increase of exactly 15 kHz on the ninth crystal multiple will not be obtained with each crystal. For a given value of C111, each LO crystal will exhibit a different frequency "spread" when C111 is switched into and out of the circuit. Ideally, the spread on the ninth multiple should be as close as possible to 15 kHz. To properly align the seven crystals in the LO, it will be necessary to place a capacitor (C100-C106) in series with some of the LO crystals. These capacitors effectively narrow the spread of the LO crystal to which one is attached.

Construction and Alignment

Remember that the 13 MHz LO crystals are switched directly into the oscillator circuit by the 100 kHz rotary switch, so good rf construction practices, such as keeping lead length to a minimum, should be used when working in this area.

Before beginning this modification, connect the IC-230 to a dummy load and attach a VHF frequency counter to display the transmitted frequency. Icom requires that each channel of the rig be within 750 Hz of the correct frequency. Check the CO alignment by reading each frequency from 146.01 to 146.28 in 30 kHz steps, which checks each of the ten CO crystals against one LO crystal. Next, check the LO by reading 146.01 to 147.81 in 300 kHz steps, which checks each LO crystal against one CO crystal. If there are any discrepancies, be sure you know which circuit is out of adjustment before changing the crystal trimmer settings. The IC-230 manual will be of help here.

Now begin construction of the circuit as shown, using the schematic (Figs. 2 and 3) and photographs as a guide. Install all components *except* C100-C106. Instead, leave the wires to P-1 intact. Switch S-100 is installed by removing the front panel of the rig and placing the mounting hole in the chassis above and between the two rotary switches. S-100 is mounted horizontally, and the toggle extends through the front panel between the 100 kHz and 10 kHz display windows. Before drilling through the front panel plastic, place a piece of masking tape on the other side, so a clean hole results. Use a small circular file to elongate the hole to accommodate S-100.

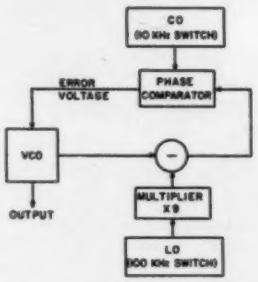
After installing these components, set C111 to mid-range and close S-100. In my rig, S-100 is mounted so that when the toggle is facing left, the switch is closed, setting the rig up for standard 30 kHz step frequencies. Now recheck the LO for correct alignment as before, and adjust each LO crystal trimmer as necessary. Each trimmer should be close to its full open position. Record the frequencies obtained with each LO crystal, down to the nearest 100 Hz, in a column.

Now open S-100 and record the new frequencies obtained with each LO crystal in another column. Determine the spread of each LO crystal by subtracting the two frequencies obtained with that crystal. Choose the LO crystal which gives the smallest spread, and adjust C111 to set this spread to 15 kHz. Now the other LO crystals will all yield spreads above 15 kHz. Capacitors C100-C106 will be used as necessary to decrease the spread of the other LO crystals. These capacitors should be silver mica or polystyrene, to insure good temperature stability. A 100 pF capacitor used in this manner will decrease the spread of the associated LO crystal by approximately one kilohertz. The addition of these capacitors also necessitates readjusting the LO crystal trimmers, with S-100 in the normal position, for the correct standard frequency. In my IC-230, five of the seven crystals in the LO needed a 100 pF series capacitor, and the other two required no capacitance here. This combination resulted in all frequencies being within 400 Hz of the desired channel frequency.

Since I spent considerable time and effort obtaining this close tolerance, I recommend being content with the more relaxed 750 Hz standard used by Icom, since no noticeable "off frequency" distortion occurs in this case. This 750 Hz standard allows for a frequency spread of between 13.5 and 16.5 kHz on the ninth multiple of each LO crystal.

It is possible that some of the LO crystals will be difficult to tune in the manner described. In my unit, one crystal stopped oscillating,

Fig. 1. Block diagram of the frequency synthesizer portion of the IC-230.



evidenced by the S-meter light extinguishing, just before its ninth multiple was raised 15 kHz. Another LO crystal required a significantly smaller series capacitance than the others to obtain the desired frequency spread. Replacements from Jan Crystals were installed, and both problems were solved. Remember to follow crystal ordering procedures outlined in the IC-230 manual.

Automatic Simplex and Repeater Offset

The circuit described here automatically selects a +600 kHz transmit offset for receive frequencies of 146.01 to 146.37 and 147.00 to 147.39, simplex operation for 146.40 to 146.58 and 147.42 to 147.57, and a -600 kHz transmit offset for 146.61 to 146.97 and 147.60 to 147.99, all obtained with the power switch in the REP position and the repeater select switch in the REP A position. In addition, position A on the 100 kHz rotary switch sets the transmit offset at -600 kHz, and position B sets the offset at +600 kHz, for both the 146 and 147 MHz band

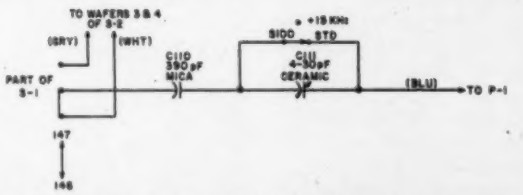
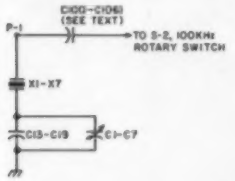


Fig. 2. Schematic of the +15 kHz switching circuit. S-100 is the miniature toggle switch that is mounted on the front panel of the rig. Opening S-100 places C111 in series with the particular LO crystal being used, raising the ninth multiple frequency by 15 kHz.

Fig. 3. Capacitors C100-C106 are mica types placed in series with each LO crystal, as necessary, to equalize the effect of C111. A 100 pF capacitor here decreases the frequency spread of its corresponding LO crystal by about 1 kHz at its ninth multiple, when S-100 is switched between the STD and +15 kHz positions.



segments. This provides for convenient selection of normal and reverse repeater operation, and simplex on the standard frequencies, for both the 146 and 147 MHz bands. Also, if the split repeater and simplex frequencies are added as described before, the system automatically selects proper transmitter offset for either the California or new York plans for split repeater setup. If the power switch is placed in the DIR position, the automatic transmit offset feature is defeated, and all frequencies are set up for simplex operation.

Circuit Description

The correct transmit offset is determined merely by the position of the 100 kHz rotary switch. The offset is +600 kHz for positions B, 0, 1, 2, and 3; simplex for positions 4 and 5; and -600 kHz for positions 6, 7, 8, 9, and A. The circuit consists of two parts, shown in Figs. 4 and 5. The first part wires the front wafer of S-2, which is the 100 kHz rotary switch, along with the power switch S-4, into the logic required for automatic transmit offset. The second part combines some of the 30 kHz spacing of the crystal switching logic, originally utilizing the first two wafers on the 100 kHz rotary switch, into the second wafer alone.

The original purpose of wafers 1 and 2 of the 100 kHz switch S-2 is to switch a regulated 9 volt supply to one of three lines, labeled A, B, and C, which are routed to the 10 kHz switch CO-S-1. This allows the 9 volt supply access to the CO module only when the combination of LO and CO crystals selected corresponds to the frequency shown on the front panel.

The front wafer of S-2 switches the 9 volt supply to lines A, B, and C in a manner consistent with operation on the 147 MHz segment of the band, while the second wafer is set up in a similar manner for the 146 MHz segment. In effect, when operation is changed from 146 to 147 MHz, line A is transposed to line C, line B to line A, and line C to line B. This is also easily accomplished by adding switching transistors Q100-Q105. Each line (A, B, and C) is connected to two transistors, corresponding to 146 and 147 MHz, which is still determined by push-button switch S-1. Activating the proper transistor allows the regulated 9 volt supply to pass to the correct line from the second wafer of S-2, which is the only wafer now needed for this switching logic.

The IC-230 uses diode crystal switching for determining the desired transmit offset. This method is simple in that the 12 volt supply is the only thing that need be switched. With the REP A-B switch in the REP A position, +12 volts is switched to the power switch which, if in the REP position, transfers the 12 volts to the rotor of the front wafer on the 100 kHz rotary switch, which diverts the 12 volts to the correct offset crystal switching circuit. With the power switch in the DIR position, the 12 volts is sent directly to the crystal switching circuit that provides simplex operation. If the REP A-B switch is moved to REP B, the 12 volts is diverted to the auxiliary transmit offset crystal located on the LO crystal socket SO-1, if this modification is also incorporated in the rig. The two diodes attached to the 100 kHz rotary switch allow the REPTR indicator light to come on only when a repeater frequency is dialed.

Construction

Although the IC-230 is densely wired in the vicinity of the 100 kHz rotary switch, there should be no problems accomplishing the changes if care is exercised.

Remove the top and bottom covers, front knobs, and front panel from the rig. The mic plug need not be removed from the front panel, if the panel is rotated away from the rotary switches. Remove the 146-147 MHz push-button switch from the top of the rig by unsoldering as many wires (make note of their positions!) as necessary to enable the switch to be moved away from the front two wafers of the 100 kHz switch. Turn the rig over and remove the screws from the two 3-lug terminal strips near the 100 kHz switch. Set the dial of this switch to the zero position, and remove the dial. Slide all obstructing panel lights rearward until they are free of their respective grommets, and move them out of the way. Now remove the control nut holding the 100 kHz switch in place, and slide the switch back about a centimeter to gain access to the front wafer.

Attached to the front two wafers of the 100 kHz switch are a white and a gray wire from the 146-147 MHz switch, and a line A (orange), line B (blue), and line C (red) wire, which connect the 100 kHz switch to the 10 kHz switch. All of these wires should be removed at both ends, and their positions noted.

Now remove all additional wiring from the front wafer of the 100 kHz switch, and leave all wiring on the second wafer intact. Interconnecting wires between wafers may be cut where they first attach to the second wafer before the portion attached to the first wafer is removed.

On the bottom side of this switch, note that the front and second wafers each had two lugs connected together to a pink wire. These represent switch positions A and B. The other four lugs on this side represent positions 9, 8, 7, and 6. All lugs appear in the same order as the numbers in the selector window when the frequency knob is rotated. Keeping this in mind, connect the 6, 7, 8, 9, and A lugs together, the 0, 1, 2, 3, and B lugs together, and the 4 and 5 lugs together. The pink wire attaches to the A and B lugs of the second wafer only.

Now remove the wires which go to the REP A-B switch, located on top of the rig, and remove the other end of the wire from this switch to the power switch. Attach an extension of the purple wire, which switches the 11.7 MHz crystal, to lugs 0, 1, 2, 3, and B of the 100 kHz switch. Attach an extension of the light green wire, which switches the 10.1 MHz crystal, to lugs 6, 7, 8, 9, and A of the same switch. The 10.7 MHz crystal is already connected by a pink wire to the DIR side of the power switch. Connect a wire from here to lugs 4 and 5 of the 100 kHz switch. Connect the two diodes between the 100 kHz rotary switch and the REP A-B switch, as shown. Connect a wire from the 100 kHz switch rotor lug to the REP side of the power switch, S-4.

Attach a wire to the +12 volt supply, located on pin 3 of the accessory socket, and attach the other end to the center terminal of the REP A-B switch. Connect the REP A side of this switch to the same center terminal of the power switch from which a wire was previously removed. If this modification is used alone, the switch on top of the rig may be left permanently in the REP A position. However, if the non-standard

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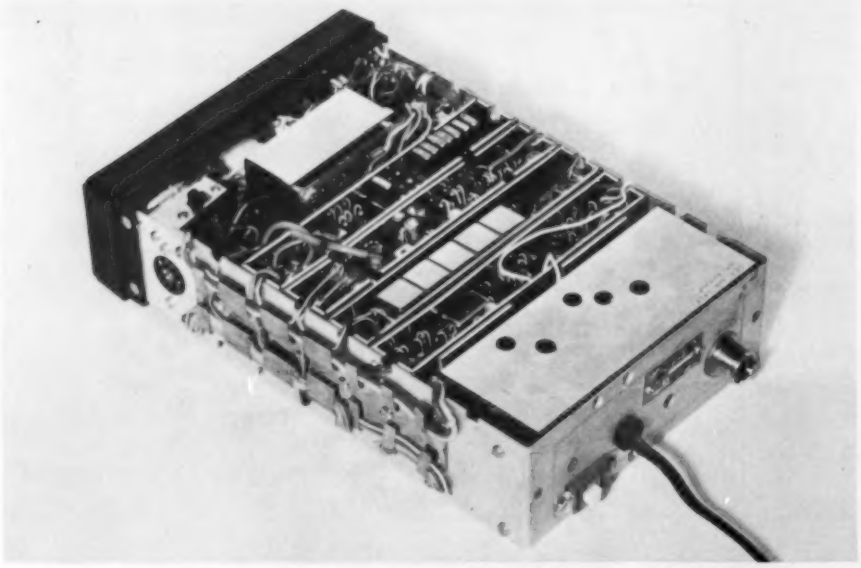
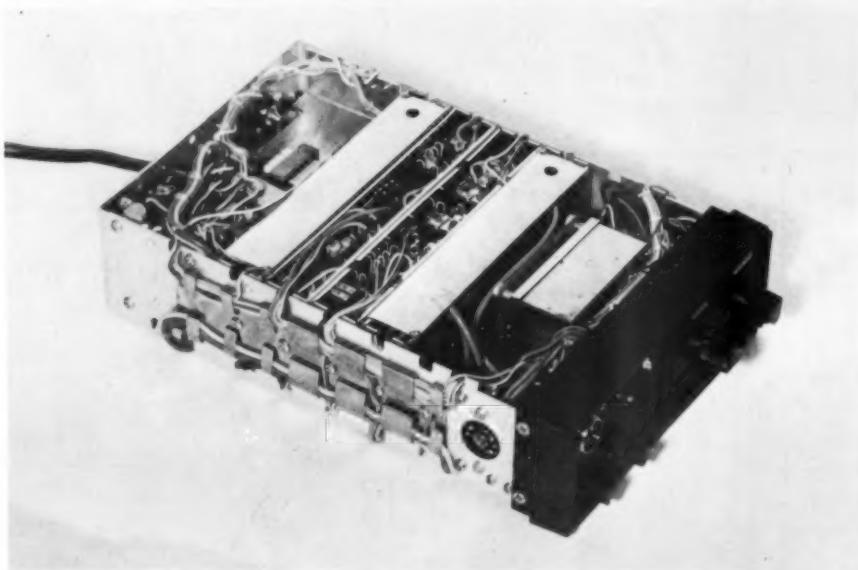


Top view of the IC-230. C111 is located directly in front of the seven LO crystals, and is mounted on a small right angle aluminum bracket. C100-C106 are attached to P-1, which is located next to C111. The PC board used in the automatic repeater offset modification is shown in place on the lid of the CO module. The additional non-standard repeater crystal is located on the far side of the LO crystal socket, and the three-lug terminal strip is mounted on the side of the rig behind the REP A-B switch.

repeater offset modification is made, as described later, the REP B side of this switch will be used.

Now remove the lid to the CO shield box, located on the rear wafer of the 10 kHz switch, and cut a piece of PC board the same size as this lid. Etch and drill this PC board to match the schematic (Fig. 5) and photo, and mount it on the lid of the CO shield box after all components and wires are soldered into place. (Since this circuit is elementary, no PC board layout is given here, other than in the photograph. It is recommended, though, that all external wire connections be grouped to one side of the PC board, as shown in the photo, to facilitate installation.) It may be necessary to file the mounting spacers as short as possible so the components will fit next to P-1 on the LO module.



Bottom view of the rig. The high/low power switch is mounted on the back panel of the rig, along with R120 attached directly to the switch terminals. The mix module contains the three standard transmit offset crystals, two of which are visible in their sockets.

It should be noted that if both the automatic repeater selection and the split frequency features are added, there are two frequency combinations which will result in operation outside the two meter band. Normally, the simplex split frequency of 147.405 MHz is obtained by dialing 147.39 MHz and raising this by 15 kHz with the added front panel switch. However, if the power switch is left in the REP position, the transmit frequency will be 600 kHz higher, or 148.005 MHz. Therefore, for this simplex frequency, the power switch must be in the DIR position for correct operation. Secondly, if 147.99 MHz is selected, with the power switch in the DIR position and the frequency raised by 15 kHz, the receive and transmit frequency will be 148.005 MHz.

Non-standard Repeater Offset

This modification allows placement of an additional transmit offset crystal in the far right socket, which is presently unused, of the LO module. When the switch on top of the rig is placed in the REP B position, this new offset crystal is used by the mix module to determine the transmit frequency. This function operates regardless of whether the power switch is in the DIR or REP position, and when the non-standard offset is being used, the REPTR lamp lights dimly as an indicator.

If this additional repeater offset feature is added to the IC-230 without incorporating the automatic repeater offset modification, a separate switch will have to be used for this circuit, since the REP B portion of S-5 will not be available for this use.

Circuit Description

Fig. 4 shows that this new circuit is merely an addition

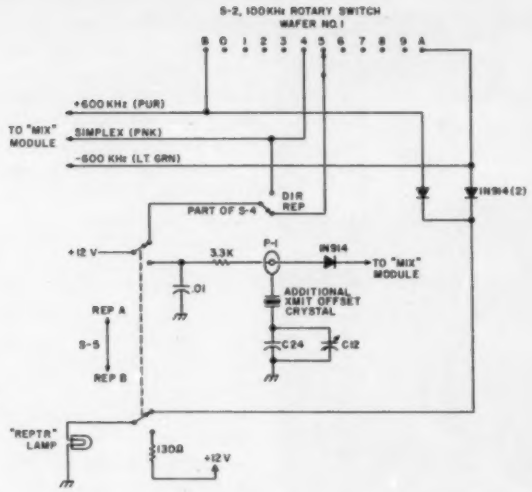


Fig. 4. Automatic transmit offset circuit, with additional non-standard repeater offset crystal. With S-5 in the REP A position, standard repeater, reverse repeater, and simplex transmit offset frequencies are determined automatically. With S-4 in the DIR position, simplex operation is possible on all frequencies. Moving S-5 to the REP B position places the non-standard repeater crystal into operation, and the REPTR lamp lights dimly as an indicator.

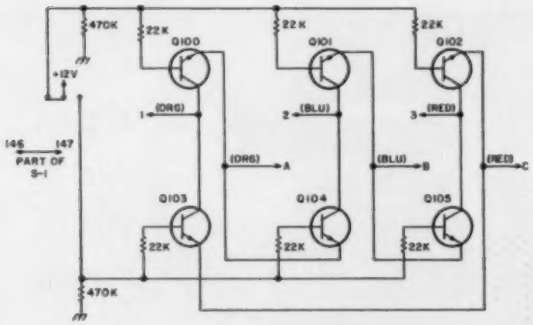


Fig. 5. Schematic of the PC board circuit which combines wafers 1 and 2 of the 100 kHz rotary switch into wafer 2 alone, allowing wafer 1 to be used as shown in Fig. 4. Q100-Q105 are silicon switching transistors. Lines 1, 2, and 3 are from wafer 2 of the 100 kHz rotary switch. Lines A, B, and C connect to their corresponding places on the 10 kHz rotary switch. All resistors are 1/4 Watt.

of one more crystal to the diode switching network already used to determine transmit offset, located in the mix module. When the REP A-B switch is in the REP B position, this non-standard offset crystal is switched into the circuit at the mix module, along with a 130 Ohm resistor in series with the REPTR lamp.

Construction

Begin construction by marking the position of and removing each wire on the mix board. This is the second module from the front on the bottom side of the rig, which contains the three transmit offset crystals. Now loosen the screws located on each side of the mainframe to which the module is mounted, and remove it from the mainframe. Drill small holes for the pin connector (if desired) and switching diode somewhere near the crystal end of the module. Install the diode and connector, and replace the mix module in the mainframe. Install a three-lug terminal strip at a convenient location in the rig, and wire it according to the schematic. The wire which runs between this terminal strip and the mix module should be routed under the bus clips on the side of the rig. Complete the modification by removing the REPTR lamp red wire from the power switch and moving it to the switch on top of the rig; finish wiring this switch by following the schematic.

The correct crystal frequency in this circuit may be obtained by adding the desired transmit offset frequency to 10.7 MHz, and installing a crystal of this frequency in the socket on the far right side of the crystal bank in the LO module. The transmit frequency may be set exactly by adjusting the correct trimmer while observing the transmitter frequency on a counter.

High/Low Transmitter Power Switch

In my unit, the high/low transmitter power switch is mounted on the back of the rig, and the circuit is similar to that used in the IC-22. In the HI position, the rig operates normally. When switched to LO, the transmitter power is reduced to about 1/2 Watt or more, determined by the setting of an added internal potentiometer. In addition, the low power setting turns off all front panel lights except the meter light, and the red transmit light, which operates normally. In this manner, the current drain on receive is cut nearly in half, which, along with the reduced transmit power, extends battery life when the rig is used as a portable.

Circuit Description

The EPS module, located next to the speaker, contains a control circuit which adjusts the voltage to the transmitter driver and final transistors, determined by the swr on the antenna, for protection purposes. In the low power position, a small PC-type pot is placed on the collector of Q1, as shown in Fig. 6, which lowers the voltage to the transmitter in the same manner. Also, the ground return on the 146, 147, REPTR, and the 100 kHz and 10 kHz dial lights is opened, extinguishing those lights.

Construction

Remove the EPS board, located opposite the antenna connector on the bottom side of the rig, and note that a 10k resistor is mounted on the foil side of the board, near the center. One side of this resistor is joined to a 4.7k resistor on the top side of the board. This is the point to which the wire to the high/low power switch should be attached. Find the white (ground) wires on the 146, 147, REPTR, 100 kHz and 10 kHz digit lamps, and connect them all to a single wire, which should be routed via the bus clips on the side of the rig back to the high/low power switch. Exposed connections should be covered

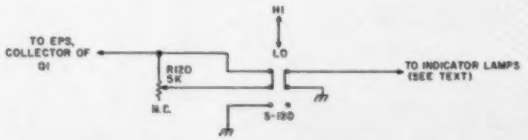
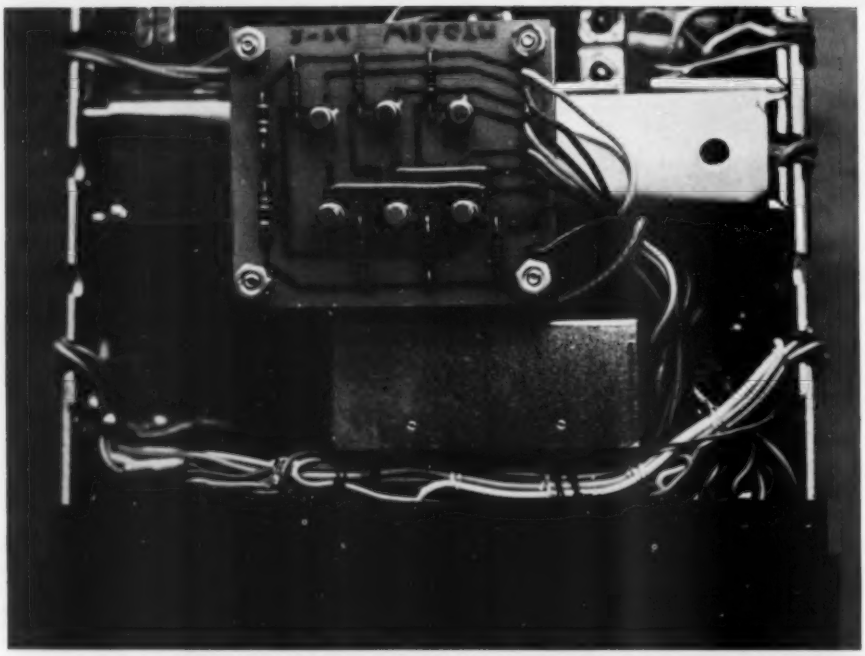


Fig. 6. The high/low power switch mounts on the back of the rig, and incorporates a circuit similar to that used in the IC-22. R120 is a PC mount pot, and may be soldered directly to the switch terminals. S-120 is a standard size DPDT slide switch.



The PC board used for part of the automatic transmit offset modification is shown with all wires attached. From the top down, the wires are: 146 MHz; C; B; A; 1; 2; 3; gnd; 147 MHz.

with heat shrinkable tubing where appropriate.

When setting the low power with R120, key the transmitter and note that the meter still indicates relative rf power. This power can be reduced so that the meter shows a reading between 1 and 2 to obtain the greatest difference between the high and low transmitter power output. Any attempt at a lower power setting may cause the driver and final transistors to stop oscillating.

Conclusion

It is my experience that each modification described here plays a significant part in improving the versatility and convenience in operating the IC-230. In addition, some of these circuit principles could be applied to other rigs as well. For example, each crystal in a discrete channel rig could be raised by 15 kHz, to obtain a limited split channel capability. Some form of the automatic repeater offset circuit could be applied to other synthesized rigs. Finally, a switch which cuts off all indicator lights will prolong battery life on any rig when used as a portable. ■

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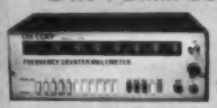

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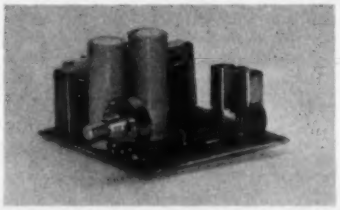

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1N5145	10/$1	2N2955 to 2N2956	5/$1	2N6488	2/$1	TIS73 to TIS74	3/$1	MDCJ DIP	.35
1N4154*	20/$1	2N3053	5/$1	2N6491	$2.50	TIS75		74DCJ DIP	1.00
1N4370 to 1N4372	3/$1	2N3053A	5/$1	2N6492	$1	DIGITAL IC's		74DCJ mDIP	.50
1N4728 to 1N4759	3/$1	2N3053A	5/$1	2N6495	3/$1	SN54/7400N	$0.35	LM1309N	1.15
1N4933	10/$1	2N3055	5/$1	2N6497	4/$1	SN54/7402N	.35	LM1458N*	3/$1
1N5221 to 1N5259	4/$1	2N3055	4/$1	2N6498	4/$1	SN74H00N	.10	LM2111N	$1.49
		2N3442	4/$1	2N6499		SN74100N	.35	LM2240CP	1.50
		2N3553	4/$1	2N6499 to 2N6501	4/$1	SN74S38N	.70	2740DC	1.95
		2N3564	4/$1	2N6535		SN74H08N	.70	2740DC	1.95
		2N3646	4/$1	2N6539	5/$1	SN74S51N	.70	CA3035A	1.75
VARACTORS		2N3680 to 2N3681	3/$1	2N6540	5/$1	SN74S74N	.70	CA3045	.84
1N5136 to 1N5144	10/$1	2N3683	3/$1	2N6543	3/$1	SN74S74N	.35	LM3909N	.35
1N5145	10/$1	2N3691	$0.69	2N6510	3/$1	SN74H74N	.42	LM3914N1	1.45
1N5146 to 1N5148	6/$1	2N3691 to 2N3692	4/$1	2N6107	$0.99	SN74H74N	.35	CA3086*	.55
MV830 to MV832	5/$1	2N3693 to 2N3694	3/$1	2N6109	2.50	SN74S00N	.44	LM3909N	.35
MV1620 to MV1624	5/$1	2N3693*	4/$1	2N6122	$0.49			RC4194D	1.50
MV1626 to MV1628	5/$1	2N3694 to 2N3696	3/$1	2N6284	$0.99	LINEAR IC's		RC4194TK*	3.50
MV1630 to MV1634	5/$1	2N3694 to 2N3696	2/$1	2N6292	$0.29	LM1800	$2.50	RC4195DN*	1.25
MV1636 to MV1638	5/$1	2N3694 to 2N3696	4/$1	2N6387	$0.99	LM1889	.77	RC4195TK*	3.50
MV1650 to MV1652	5/$1	2N3702 to 2N3704	5/$1	2N6388	3/$1	LM3876	.77	LM4250CN	2.95
MV2101 to MV2105	5/$1	2N3705 to 2N3707	5/$1	2N6427	$0.49	LM3886	.99	RC4558DN*	.75
MV2107 to MV2109	5/$1	2N3708 to 2N3710	5/$1	2N6429	1.00	LM3900	.49	RC4558DN	.55
MV2111 to MV2115	5/$1	2N3711 to 2N3713	5/$1	2N6431	1.00	LM3909N	.35	MC1458P	.55
MV2201 to MV2205	5/$1	2N3771	$1.00	2N6432	1.00	LM3911N	1.50	µA709DC	1.25
MV2209 to MV2212	5/$1	2N3772	1.00	2N6433	1.00	LM3914N	3.50	µA709DC	1.25
MV2221 to MV2224	5/$1	2N3773	2.00	2N6435	1.00	LM3915N	3.50	8038 DIP*	3.75
MV2301 to MV2305	5/$1	2N3789	1.00	2N6491	2.50	LM3914N-10	3.50	8038 DIP*	3.75
MV2307 to MV2310	5/$1	2N3790	1.00	2N6501	12.00	LM3914N-10	3.50	SN76496J	.99

*SUPER SPECIALS:

1N914 100V/10mA Diode	20/$1	MPF102 200MHz RF Amp	3/$1
1N4001 100V/1A Rect.	15/$1	40673 MOSFET RF Amp	$1.75
1N4154 30V 1N914	25/$1	LM324 Quad 741 Op Amp	.94
BR1 50V ¾A Bridge Rec	4/$1	LM376 Pos Volt Reg mDIP	.85
2N2222A NPN Transistor	6/$1	NE555 Timer mDIP	2/$1
2N2907 PNP Transistor	6/$1	LM723 2-37V Reg DIP	3/$1
2N3055 Power Xistor 10A	.69	LM741 Comp Op Amp mDIP	4/$1
2N3904 NPN Amp/Sw /100	6/$1	LH1458 Dual 741 mDIP	3/$1
2N3906 PNP Amp/Sw /100	6/$1	CA3096 5 Trans Array DIP	.98
CP650 Power FET ¾Amp	85	RC4195DN ±15V/50mA mDIP	1.25

RF391 RF Power Amp Transistor 10-25W @ 3-30MHz TO-3	$6.00
555X Timer 1µs-1hr DIPforont pinout from 555 (w/data)	3/$1
RC4194TK Dual Tracking Regulator ±0.2 to 30V @ 200mA TO-66	$2.50
RC4195TK Dual Tracking Regulator ±15V @ 100mA (TO-66)	$2.25
8038 Waveform Generator VCA Wave With Circuits & Data	$3.75

Social Events

SALT LAKE CITY UT
APRIL 30

The Utah Computer Association announces the Utah Computer Fair to be held Saturday, April 30, 1977 from 1 to 5 pm at Fashion Place Mall. Purpose: To inform the community of the place and value of personal (hobby) computers in our world. Many of our members will be bringing their computers, both home-built and professional systems, demonstrating many different applications. We will also have some manufacturer representatives and local distributors present. This is an informational gathering; there will be no selling! For further information, contact Ernie Dixon, Fair Chairman, at home (6-9 pm) at 467-9100; or at work (8:30-4 pm) at 486-7481.

BROWNFIELD TX
MAY 1

The Brownfield Amateur Radio Club will hold a Swapfest on Sunday, May 1, 1977, in Brownfield, Texas.

WEST TRENTON NJ
MAY 1

The annual Delaware Valley Radio Association (W2ZQ/WR2ADE) flea market and auction will be held on Sunday, May 1, 1977, 9 am rain or shine at the Villa Victoria Academy in West Trenton, New Jersey (the school is located adjacent to Rt. 29 near the junction of Rt. 29 and I-95). Talk-in on 07/67 and 146.52. Refreshments are available. Advance registration $1.00; $1.50 at gate. For additional information or tickets write: DVRA, PO Box 7024, West Trenton NJ 08628, SASE please.

FRESNO CA
MAY 6-8

The Annual Fresno Amateur Radio Club Hamfest will be held this year at the Airport Holiday Inn on May 6 and 8, 1977. For more information write Fresno Amateur Radio Club, Inc., 4788 N. Safford, Fresno CA 93704.

HERNDON VA
MAY 7

The Potomac Area VHF Society will hold its sixth annual hamfest on Saturday, May 7, 1977, from 8 am to 5 pm at Frying Pan Park on West Ox Road in Herndon, Virginia, which is approximately 15 miles west of Washington DC. Registration of $3 includes flea market or tail gate sales. Professional food and beverage catering and unlimited parking will be available. Talk-in on 146.52 and 31-91 repeater. This is the hamfest formerly held in Westminster MD, but moved to Virginia because of the recently enacted Maryland traders law. For further information contact K3DUA or WA3NZL.

MEADVILLE PA
MAY 7

The Third Annual Northwestern Pennsylvania Hamfest will be held May 7 at Crawford County Fairgrounds, Meadville PA. Free admission. Flea market begins at 10 am. $2 to display — hourly door prizes — refreshments — commercial displays welcome. Indoors if rain. Talk-in 146.04/64 and 146.52. Details C.A.R.S., PO Box 653, Meadville PA 16335.

SUPERIOR WI
MAY 7

The Twin Ports Two Meter Club will hold its Second Annual Swapfest on Saturday, May 7, 1977, in the hall of the Duluth First Methodist Church from 11 am to 3 pm. Pre-registration and door prizes will be awarded. Admission is $1.00 in advance and $1.25 at the door. Selling space is $1.50 additional — $1.00 with your own table. Food available on the premises. Plenty of parking. Talk-in on 34/94. For flyers and/or tickets, contact Twin Ports Two Meter Club, c/o Libby Welsh WB9MLN, 525 Homecroft Court, Superior, Wisconsin 54880.

BINGHAMTON NY
MAY 7

The 18th Annual STARC Hamfest will be held Saturday, May 7, 1977 at Binghamton, New York. Take exit 71N from NY-17, go 3.8 miles north on Stella-Ireland Road. Flea market, tech talks, hourly door prizes. General admission $2.00/person. Banquet by pre-reservation at $6.00/person. Indoor exhibit space by pre-registration at $5.00 per table. Outdoor exhibit flea market space free. Talk-in 146.22/82 and 94/94. For details and reservations, contact STARC, PO Box 11, Endicott NY 13760.

GREEN BAY WI
MAY 7

The Green Bay Amateur Radio Club will hold its 2nd Annual Electronic Hobby Swap on May 7, 1977 at the Wisconsin Army National Guard Building, 800 N. Military, Green Bay, Wisconsin. Swap runs from 8 am til 4 pm. Admission $2.00; table space $2.00. Food, refreshments, entertainment, prizes, etc. For further info contact David Boyce WB9QYJ, 706 Mather Street, Green Bay, WI 54303, or Bob Heiser WA9SWX, 1547 Foeller Drive, Green Bay, WI 54302.

BIRMINGHAM AL
MAY 7-8

The Birminghamfest Amateur Radio Convention will be held May 7 and 8, 1977 at the Alabama State Fairgrounds, Birmingham and Rodeway Inn, Oxmoor at I-65 and Oxmoor Road. One of the country's largest flea markets, technical and operating forums, huge prize drawing, manufacturers' and distributors' displays, ladies' and children's activities. Booth display area will be offered free of charge to bona fide distributors, manufacturers, publishers, etc., on a first-come, first-served basis. Others may rent space in inside or outside flea market areas at a small charge. No admission charge. Prize ticket donations — $1. Talk-in 34/94, 3965 kHz. For booth display space, information, and reservations, write: Birminghamfest, PO Box 603, Birmingham AL 35201.

KEY WEST FL
MAY 7-8

The Second Annual Key West Conch-fest will be held May 7 and 8, 1977. $12 includes one dinner and admission to many attractions in the Key West area. Door prizes will be awarded. Reservations and room information available from Dennis Farr, 1831 Harris Ave., Key West FL 33040.

SANTA BARBARA CA
MAY 13-15

The 22nd annual West Coast VHF Conference will be held on May 13-15, 1977 at the Miramar Hotel on the beach in Santa Barbara CA. The event opens with registration at 6 pm Friday (May 13), followed by a full day of technical presentations starting at 9 am, Saturday. Pre-registration fee is $2 until April 30. After that and at the door, $3. Registration forms, hotel information, and further details may be secured by writing Dr. Overbeck at the Communication Division, Pepperdine University, Malibu CA 90265.

WARMINSTER PA
MAY 15

The Warminster Amateur Radio Club's "HAMMART," Flea Market and Auction will be held Sunday, May 15 from 9 to 4 at William Tennent Intermediate High School, Street Road (Route 132), 2 miles East of York Road (Route 263), Warminster, Bucks County, Pa. Registration $1, tailgating $2 additional. Talk-in on 147.69-09; 146.16-76 and 146.52. For further information write to Horace Carter K3ZAC, 38 Hickory Lane, Doylestown PA 18901.

IRVINGTON NJ
MAY 15

The Irvington Radio Amateur Club Hamfest, Flea Market will be held Sunday, May 15, 1977 from 9 am to 4 pm at the P.A.L. Building, 285 Union Ave., Irvington, NJ. The P.A.L. building borders the Garden State Parkway at Exit 153. Talk-in 34-94 and 52. Prizes and refreshments. Tables $3. For further information write Radio Club P.A.L., 285 Union Ave., Irvington, NJ 07111 or call Ed WA2MYZ 201-687-3240 evenings.

WEST LIBERTY OH
MAY 15

The Champaign/Logan Amateur Radio Club will hold its annual flea market on May 15, 1977, at the West Liberty Lion's Park, West Liberty, Ohio. Free admission. Trunk sales and tables $1.00. Door prizes. Talk-in on 146.52.

ROCHESTER NY
MAY 20-22

The Rochester Hamfest (combined with the New York State ARRL Convention) will be held May 20-22, 1977 in the Dome Center at the Monroe County Fairgrounds. The show will open at 9 am Saturday; closing will be at 5:30 pm. The show will reopen on Sunday 9:30 am and run until 5 pm. Eight by ten foot booths are available for only $100 each payable in cash only, in advance. Multiple booths are available at reduced rates: double $180; triple $250. For additional information contact E. Ashley Palmer K2EAW, 1776 Hudson Ave., Rochester, NY 14617 or call 716-338-2180 during working hours.

CADILLAC MI
MAY 21

The Cadillac, Michigan 17th Annual Swap-Shop will be held Saturday, May 21st, 1977, at the National Guard Armory, Cadillac, Michigan. Free parking, everyone welcome. Tickets $2.00. Talk-in on 146.37/97.

RAVENNA OH
MAY 21

The Hanna Hills Radio Club located at 5555 Newton Falls Road, Ravenna OH 44266, will sponsor an auction at the Survival Center Saturday, May 21, 1977. Flea market at 10 am; auction at 2 pm. Tickets at door $2. Bring your own flea market tables. Directions to QTH on 146.52 simplex.

LAKE DELTON WI
MAY 21

The 1977 ARRL Wisconsin State Convention will be held Saturday, May 21, 1977 at the Dell View Resort in Lake Delton, Wisconsin. From the south, take the Highway 12 exit, head north to the Resort. From the north, take the Highway 23 exit and go east to the Resort. Talk-in station WB9FDZ on 146.94 MHz. There will be ladies' activities, directional bearing and transmitter hunt, liars' contest, etc. For info and advance registration, contact Ken Ebneter K9EN, 822 Wauona Trail, Portage, WI 53901. This convention sponsored by the Yellow Thunder Amateur Radio Club, Inc.

VANCOUVER WA
MAY 21-22

The Fort Vancouver Hamfair will be held Saturday and Sunday, May 21 and 22 at the Clark County Fairgrounds, 7 miles north of Vancouver

CORRECTION

On page 158 of the March issue of *73*, we published an erroneous ad for Hamtronics. There is no reward being offered. *73* goofed! Our apologies to anyone who has been inconvenienced.

on I-5. Sponsored by W7AIA, Clark County Amateur Radio Club, in cooperation with W7KYC, Portland Amateur Radio Club. Camping, contests, swap & shop, prizes, displays, and many other activities. Registration donation $3. Send registrations to Dorman Stafford W7ZDR, Registration Chairman, Fort Vancouver Hamfair, 3509 E 21st St., Vancouver WA 98661. Make checks payable to Fort Vancouver Hamfair. Talk-in on 2 and 75 meters.

PITTSBURGH PA
MAY 22

The 23rd annual Breeze Shooters Hamfest is Sunday, May 22, 1977 at White Swan Park, Parkway West, near the Greater Pittsburgh International Airport. Western Pennsylvania's largest ham event. Amusement park adjacent to site. Free parking. Contact WA3LUM, 311 Evergreen Ave., Pittsburgh, PA 15209.

TRENTON TN
MAY 22

The Humboldt Amateur Radio Club's Annual Hamfest will be held on Sunday, May 22, 1977 at Shady Acres City Park in Trenton, Tennessee. Flea market, prizes, ladies activities, etc. For further information contact Ed Holmes W4IGW, 501 N. 18th Ave., Humboldt, TN 38343.

EVANSVILLE IN
MAY 22

The Tri-State Amateur Radio Society is holding its annual hamfest on Sunday, May 22, at the Vanderburgh County 4-H Center in Evansville, Indiana. There will be food available, setup space, door prizes, grand prizes, and more. Bring your XYL, YL or OM, there will be fun for all. Talk-in frequencies are 75/15, 19/79 and 52. For further information please write TARS, Steven Harris, R-2 Box 81G, Mt. Vernon, Indiana 47620.

SANDUSKY OH
MAY 22

The Erie Amateur Radio Society will hold their annual Vacationland Hamfest on Sunday, May 22, 1977 at the Erie County Fair Grounds on South Columbus Ave., Sandusky, Ohio. Plenty of flea market tables @ $4 each. 8 acres for trunk sales. First grand prize is a color portable TV. Tickets $1.50 advance, $2 at gate. Flea market vehicles $1 each. Free transportation to Cedar Point Ferry Boat Docks. Call in on 52/52 FM. For further information or reservations write E.A.R.S., P.O. Box 2037, Sandusky OH 44870.

EASTON MD
MAY 22

The Third Annual Easton Amateur Radio Society Hamfest will be held on May 22, 1977, rain or shine, 10 am to 4 pm. This is the only hamfest held on the Eastern Shore of Maryland or on the Del-Mar-Va Peninsula. It's located 5 miles north of Easton, Maryland on US Rt. 50, at the Talbot County Agricultural Center. From the Baltimore or DC area, go across the Chesapeake Bay Bridge and follow Rt. 50 East for 21 miles from the bridge. Exact location is between mile markers 60 & 61. Hamfest signs will be on Rt. 50 both north and south, and talk-in on 52 and 146.445-147.045 repeater in Cambridge. Some tables available, refreshments, and prizes. Donation $2.00 with an additional $2.00 for tables and tailgaters. For further info contact Robert L. Roberts, Jr. K3ONU, PO Box 781, Easton MD 20601 or phone after 6 pm 301-822-0943.

WEBSTER MA
MAY 22

The Eastern Connecticut Amateur Radio Association will hold their 4th Annual Flea Market on May 22, 1977 at Point Breeze Rest., Webster, MA. Time will be from 10:00 am to whenever. Dealer fee will be $5.00, admission $.50 per person. Free parking. Take Rt. 52 to Exit 1 in Webster then south on Rt 193 one mile. Look for signs. Talk-in on 52 direct, 16-76, 10-70, 825-225 channel 14.

WABASH IN
MAY 22

The Wabash County Amateur Radio Club's 9th Annual Hamfest will be held Sunday, May 22, 1977, at the Wabash County 4-H Fairgrounds in Wabash, Indiana. Large flea market (no table or setup charge), technical forms, bingo, plenty of parking and lots of good food at reasonable prices. Admission is $2.00 for advance tickets, $2.50 at the gate. For more information or advanced tickets write Bob Mitting, 663 N. Spring St., Wabash, IN 46992.

DURHAM NC
MAY 28-29

The DURHAMFEST will be held May 28-29, 1977 at the South Square Shopping Center in Durham, NC. There will be a two-day flea market, fantastic prizes, seminars, bingo and shopping held for the family. Talk-in on WR4AGC: 22-82 and 222.34-223.94. For further information contact Durham FM Association, Box 8651, Durham, NC 27707.

BURLINGTON KY
MAY 29

The Kentucky Ham-O-Rama will be held Sunday, May 29 (Memorial Day Weekend) at Boone County Fairgrounds, Burlington, Kentucky. 10 minutes south of Cincinnati, Ohio, 2 miles from I-75 South, Burlington exit. Prizes, exhibits, flea market. Info: NKARC, PO Box 31, Ft. Mitchell KY 41017. Tel. (606) 331-4922.

MINNESOTA
JUNE 4

Amateur Fair '77: Dakota Division's largest Swapfest for amateur radio operators and computer hobbyists. Saturday, June 4th at the Minnesota State Fairgrounds. Free overnight parking for self-contained campers. Talk-in on 16/76 and 52/52. Selling from your car or from our tables. Some "undercover" space available. Presented by the Twin City FM Club. Prizes include: Wilson HT, Bird Model 43 Wattmeter, and much more. Admission $2. For advanced space reservations, tickets or information call Gary at (612) 644-4488.

HERNANDO MS
JUNE 11-12

The Chickasaw Amateur Radio Association, Inc., "CARA," of Hernando, Mississippi presents its annual Tri-State Hamfest June 11-12, 1977 at the National Guard Armory in Hernando, Mississippi, 20 miles south of Memphis, TN on Interstate 55. Plenty of parking area with camping sites. Tables available at $2.00. Doors open 12:00 to 6:00 Saturday, June 11th, and 8:00 to 4:00 Sunday, June 12th. Prizes, food, and beverages. Talk-in on 146.31/91, 146.52, and 3987.5. For further information write CARA, PO Box 2, ATTN: R. Gates, Hernando MS 38632.

NEWBERRY MI
JUNE 12

The Tahquamenon Amateur Radio Society swap and shop will be held Sunday, June 12, 10 am to 6 pm at the Pentland Township Hall, 3 miles south of Newberry and 2 miles west

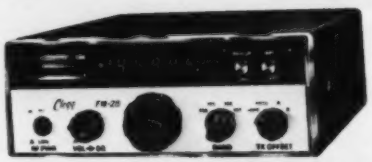
Continued on page 188

FM-28 HUSTLER ANT'S TOUCHTONE PADS FM-76 031A

POWER SUPPLIES FM-DX KLM AMPLIFLIERS ANTENNAS

PHELPS DODGE ANT'S TOUCHTONE HANDSETS CRYSTALS

Clegg FM-28



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Alan S. Kaul W6RCL
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Chatsworth CA 91311

CB to 10 - -

A Legal Alternative

- - part II: conversion data

How about a brand new DX transceiver that's rock stable, plugs into your cigarette lighter, and tunes 23 frequencies on 10 phone for less than $30? Of course, there are a couple of drawbacks – power output 4 Watts, and an emission type the sideband guys call Ancient Modulation – but those problems are hardly worth mentioning. Just ask any old-timer who worked the peak of the '46-'48 sunspot cycle. You *can* do wonders with just a few Watts on 10 phone, and the technical specs on the $29.95 transceiver make it a superior performer to what was available in 1946.

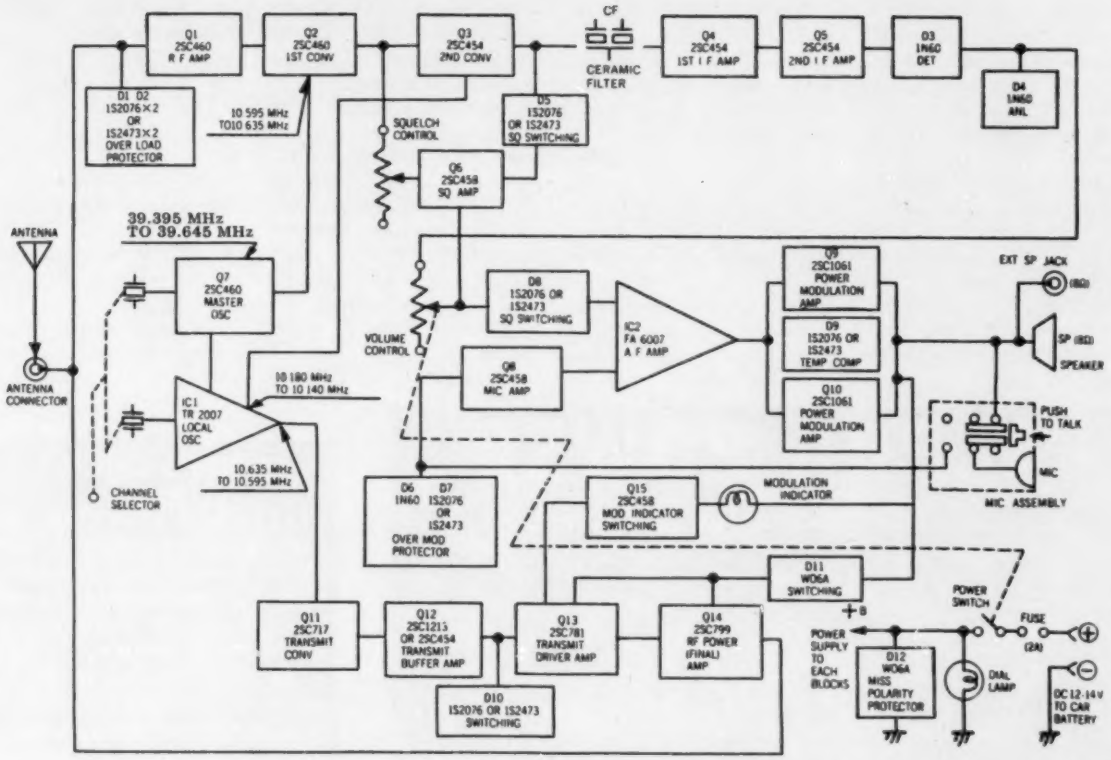
For several years, I've been watching the want ads and going to swap meets in search of the perfect junk CB rig. I had plans for picking up one for just a few dollars, changing a few crystals and – presto – getting on ten phone quick and dirty. I never really found what I wanted for a cheap enough price (CB SSB was always too expensive!) and I soon lost interest. And besides, I was busy getting onto two meter FM, plus I didn't want to give up working the low bands on CW or SSB. All of that was before the FCC approved 40 channel CB for use after January 1, 1977. When a lot of manufacturers started dumping their older model 23 channel sets on the market at bargain prices, I got reinterested in recycling a CB radio up onto 10 phone. I watched the ads and finally bought a J. C. Penney transceiver model 981-6201. It is a quality piece of gear that usually sells for twice the price. There are 2 ICs, 12 diodes, and 15 transistors in a double conversion receiver and AM transmitter configuration. The manufacturer claims 0.5 microvolt sensitivity at a 10 dB signal plus noise to noise ratio. Power output from the 2SC799 rf amplifier is listed at 4 Watts and the spec sheet advertises 90% modulation. Loaded, the transmitter draws 1.4 Amps at up to 13.8 volts (easily obtainable from the cigarette lighter in your car or from a small ac supply). The rig has a built-in squelch circuit, but is not equipped with an rf tuning indicator or receiver S-meter.

10 Meter Channel	Frequency (MHz)	Master Oscillator Frequency
1	28.76	39.395
2	28.77	
3	28.78	
4	28.80	
5	28.81	39.445
6	28.82	
7	28.83	
8	28.85	
9	28.86	39.495
10	28.87	
11	28.88	
12	28.90	
13	28.91	39.545
14	28.92	
15	28.93	
16	28.95	
17	28.96	39.595
18	28.97	
19	28.98	
20	29.00	
21	29.01	39.645
22	29.02	
23	29.05	

Table 1. Frequency coverage of the $29.95 DX transceiver.

When the Citizens Band was created in the 1950's, the early rigs used 23 pairs of crystals to tune both transmit and receive on all 23 channels. Converting one of those rigs to 10 phone would cost a small fortune to crystal up, but I was prepared to pay it until Norm Lefcourt W6IRT mentioned that the newer CB rigs use crystalplex, replacing the old 46 crystals with 14 new crystals and still covering all 23 channels. Norm pointed out that by replacing the six master oscillator rocks, I could cover 23 frequencies simplex on the 10 meter band with just a little tweaking of a few L/C circuits. W6IRT, WA6QPL, K6JUA, others and I all started working on the conversion. K6HY, K6LJJ, and WB6QKF helped with advice.

It sounds pretty easy, but there was a problem – deciding on which frequencies on 10 phone to use. The phone portion of the band is gigantic when compared to the other HF bands, and we wanted to pick a segment where there would be some activity. We didn't want to cause difficulties for other services, yet at the same time we wanted to stay near the low end so that retuning from the CB frequencies would not require a rewinding of coils. After an awful lot of discussing on the landline and two meter FM, we decided to stay away from both the very top end of the 10 phone segment (because of OSCAR) and from the very bottom end, too (because of the SSB DX activity just above 28.5). We finally settled on a starting frequency of 28.76 MHz for channel one, with the other 22 channels tuning upward from there. The decision was based on two practical considerations: First, the pres-


Q1 2SC460 R F AMP
Q2 2SC460 1ST CONV
Q3 2SC454 2ND CONV
CF
CERAMIC FILTER
Q4 2SC454 1ST I F AMP
Q5 2SC454 2ND I F AMP
D3 1N60 DET
D4 1N60 ANL
D1 D2 IS2076×2 OR IS2473×2 OVER LOAD PROTECTOR
10 595 MHz TO10 635 MHz
SQUELCH CONTROL
D5 IS2076 OR IS2473 SQ SWITCHING
Q6 2SC458 SQ AMP
ANTENNA
39.395 MHz TO 39.645 MHz
Q7 2SC460 MASTER OSC
D8 IS2076 OR IS2473 SQ SWITCHING
IC2 FA 6007 A F AMP
Q9 2SC1061 POWER MODULATION AMP
EXT SP JACK
SP (8Ω)
SPEAKER
VOLUME CONTROL
Q8 2SC458 MIC AMP
D9 IS2076 OR IS2473 TEMP COMP
Q10 2SC1061 POWER MODULATION AMP
ANTENNA CONNECTOR
IC1 TR 2007 LOCAL OSC
10 180 MHz TO 10 140 MHz
10 635 MHz TO 10 595 MHz
CHANNEL SELECTOR
PUSH TO TALK
MIC
MIC ASSEMBLY
D6 D7 1N60 IS2076 OR IS2473 OVER MOD PROTECTOR
Q15 2SC458 MOD INDICATOR SWITCHING
MODULATION INDICATOR
D11 W06A SWITCHING
POWER SWITCH
FUSE (2A)
+B
POWER SUPPLY TO EACH BLOCKS
D12 W06A MISS POLARITY PROTECTOR
DIAL LAMP
DC 12-14 V TO CAR BATTERY
Q11 2SC717 TRANSMIT CONV
Q12 2SC1213 OR 2SC454 TRANSMIT BUFFER AMP
Q13 2SC781 TRANSMIT DRIVER AMP
Q14 2SC799 RF POWER (FINAL) AMP
D10 IS2076 OR IS2473 SWITCHING

ence of the "10-10 club" net on 28.8 (our channel 4) could tell us very quickly when the band is open, and second, because many home QTH rigs only tune a single 500 kHz portion of the 10 meter band, choosing a frequency outside that segment would mean having to do without a very important piece of test gear – the station receiver.

The first 23 CB channels start at 26.965 and end at 27.255. Channels 1, 2, and 3 are 10 kHz apart, but there are 20 kHz between channels 3 and 4. Channels 4, 5, 6, and 7 are ten kHz apart, but between 7 and 8 there is another jump of 20 kHz. The cycle keeps repeating itself every fourth channel until channel 22, which is 10 kHz higher than channel 21 but 30 kHz lower than 23.

The J. C. Penney rig that I bought and W6IRT's Publicom #1 use six master oscillator crystals (37.600, 37.650, 37.700, 37.750, 37.800, and 37.850), four transmit crystals (10.635, 10.625, 10.615, and 10.595), and four receive (10.180, 10.170, 10.160, and 10.140). On transmit, the rig mixes the master oscillator with the transmit crystal (37.600 minus 10.635 is 26.965 – CB channel one). On receive, the receive crystals are the first i-f conversion frequency and the second i-f operates at 455 kHz. Image problems are minimized by the double conversion i-fs.

The Conversion

To begin with, you need new master oscillator crystals. The J. C. Penney rig uses six – if you want to be able to tune all 23 channels on 10 phone, you have to replace all six. If you only want four frequencies, replace only one master oscillator crystal; if you want to tune eight, replace two, etc. Not all of the crystalplex rigs use the same master oscillator frequencies – some operate in the 16 MHz range – so be sure to check the frequencies in your rig before you go out and buy new rocks. Both Norm and I are just replacing two master oscillator crystals to see how the eight channels work. But, eventually, we both plan to be outfitted with all six crystals and full 23 channel 10 meter coverage. Our new channel designations and crystal frequencies are spelled out in Table 1. Those are the frequencies we are using (along with about 30 other guys in Southern California). When you crystal up, use the same frequencies so we'll all have someone else to talk to. We will continue the CB channel designations (that saves changing the dial) so that our lowest frequency is channel one and our highest is channel 23.

After changing crystals (and a word of warning there – most master oscillator crystals are wire type and must be soldered in; BE CAREFUL!), hook the rig up to a 12 V dc supply and a suitable dummy load antenna. We found the receiver sections worked well enough so that tuning up only required peaking the rf and first mixer stage coils for maximum band noise. Transmitting is a little more complicated, but not impossible. If you don't have a voltmeter, use some kind of relative power output indicator (an swr bridge, a light bulb, etc.). Peak the coils in the transmit stage starting with the master oscillator. You don't have to peak the coil for the transmit crystals, because they still put out in the 10.600 MHz range. Peak each succeeding output stage for maximum indicator reading. If you have a voltmeter, connect it to the output of the transmit driver stage, then peak the lower stages for maximum reading. Then peak the final with some kind of power output indicator. The funny thing about the CB rigs we bought is that they all came with full and complete tune-up instructions – even though CBers aren't supposed to even touch them with a screwdriver.

Antennas: Most of the CB radios are designed for 50 Ohm output and most of the CB antennas sold are vertical-

ly polarized. Polarization probably won't make any difference on the real long haul skip, but for working ground wave with others in your area, it makes more sense to install a vertical antenna. That's what the mobiles are using anyway, and a rooftop groundplane for the home QTH is only 8 feet tall. After seeing what some of those yo-yos on 11 meters are using, I would say it won't take an awful lot to be able to get out.

The $29.95 transceiver is a good club project. If you can't find one on the market, hit the swap meets and check the ads in the local papers; you may even be able to get a better price by buying one from a disgruntled CBer who gave up trying to punch through the QRM. If you are big on modifications, I'd like to hear about them (or see them in print in case I want to try one of them). Here are a few I have in mind: A small VFO that will fit inside the transceiver case and plug into one of the master oscillator crystal sockets; a low cost linear amplifier capable of 15 to 20 Watts output; an alternate conversion for six meters or one for the low power DX guys who want to work 15 CW; a slider for receiver and/or transmitter offset tuning; a BFO; a sideband adapter; or maybe a transceiving converter to other bands.

Look for me on 10 phone. I'll be listening on channel 4 — 28.80 MHz. If I hook up with somebody, I'll QSY up or down to continue the contact. If 28.80 is busy, I'll hang out on channel 3 (28.78). How about you? If we all use the same "channels," it'll make it a lot easier to work 10 phone. If you hear me on though, don't give me any of that "... Breaker, Breaker, this is your old good buddy, got time for a 10-7 ...?" baloney. I heard all of that I could stand while I was waiting for my crystals to arrive!!! ■

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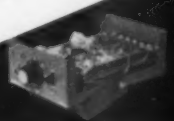

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75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	68.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
75-10 HD (SP)	75/40/20/15/10	74.50	48/1.34	66/20.1
**80-10 HD	80/40/20/15/10	76.50	50/1.40	69/21.0

NOTES
1. Models prefaced '**' will be available 1/77.
2. All models above are furnished with crimp/solder lugs.
3. All models can be furnished with a SO-239 female coaxial connector at additional cost. The SO-239 mates with the standard PL-259 male coaxial cable connector. To order this factory installed option, add the letter 'A' after the model number. Example: 40-20 HD/A.
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M11

All-Electronic SELCAL

- - uses a UART for versatility

Anthony Sperduti WB2MPZ
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There have been a few articles on the merits of the selective call (SELCAL) circuit. All of them have been on the use of the Model 28 stunt box. To those of you who are unfamiliar with the 28 stunt box, I will go over it a bit. It is a mechanical arrangement of fingers that are spring-loaded and press against the parallel code bars on the 28 machine. The code bars have slots in them, and when the slots are properly lined up to a stunt box finger, that finger will slip into the slot and provide you with a mechanical function of the machine to perform an operation such as line feed, carriage return, or almost anything you want it to do. It also will operate a switch that you must put on top of this finger. When the finger moves forward, it will operate this switch. The machine has 42 slots for these fingers in the stunt box, which is located between the paper roll and the printer. If you fully load one of these machines up with all 42 code bars, it gets a little crowded, to say the least. It also can get to be very expensive, as these little things cost around 2 bucks each. Now you have to get switches for each one and then run all the wiring to the switches. If you want to do logic with the switches, you will have to build up a heck of a lot of relays to do your logic work for you. For example, if you want a circuit to operate when you have 7 characters in a row, you must first have seven of these bars in your machine that have the characters you want coded on the ends – that is, you either buy them for your callsign or you buy the ones that have all the fingers on them and break off the ones you don't want. Once you set it up, you have had it; you cannot change anything. What I am trying to get over is that it can get expensive and really complicated with a fully loaded stunt box. If you don't have a machine with a stunt box, you can't do it. After playing around with this idea, I decided to come up with an electronic stunt box that could be used with any machine and could also be changed to any character combination that I wanted. Since hams like to have names for these circuits, I will call it the ESB-1, that is, Electronic Stunt Box One. This little circuit will do everything that any mechanical stunt box can do and do it better, faster, cheaper, and easier.

Since by now almost all RTTY people know what a UART is, I will not go into the merits of one and how it works. You will get an added benefit using the SELCAL with a UART, as not only does it enable you to have an electronic stunt box, but it also will help in cleaning up the received signal for better copy. I will go over the circuit to explain how it operates.

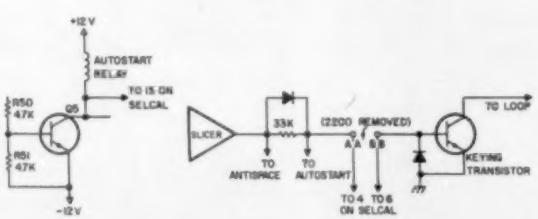

Fig. 1. ST-6 to SELCAL interface.

The UART is a GI AY5 1013 that converts the incoming teletype signal to a parallel signal. That is, it receives the serial signal and puts the bits out on five separate lines. The UART has been wired to copy a 5 bit code (Baudot). The second half of the UART now converts it back to serial again so that it can drive the TTY machine loop. The five bits are on pins 12, 11, 10, 9, and 8. Pin 12 is the first bit and 8 is the fifth bit. Note that these five lines are wired to a pair of 9311 (74154) one of sixteen decoder/demultiplexers. Pins 20, 21, 22, and 23 of the 9311s are the address lines of these chips. Pins 18 and 19 are the enable pins. Pins 1 through 17, with the exception of pin 12, are the output pins. The outputs are all active low – that is, when they are addressed, they will go low; all other times they will be high. Only one output pin at a time can go low, and then only when that chip is enabled by pulling both enable pins 18 and 19 low. In this circuit, I do not pay attention to what case the machine is in, as it can't really tell. I will assume that it is always in lower case letters. Check the truth table in Table 1 and you will see what lines address the output pins. For example, if pins 20, 21, 22, and 23 are all low, and the two enable pins are low, output pin number 1 will go low. If pin 23 is high, and 22, 21, and 20 are low, and both enables are low, output pin 2 will go low. This is a BCD code, with pin 23 being the least significant bit and 20 the most significant bit. Bit number 5 from the UART is connected to one of the enable pins (18) of num-

Pin # 18	19	20	21	22	23	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L

H = High Voltage
L = Low Voltage
X = Don't Care

Table 1. Truth table, 9311/74154.

ber 1 9311 and then inverted through the 7404 to pin 18 of the other chip. What this does is address chip number 1 when the fifth bit from the UART is low and address chip number 2 when the fifth bit is high. The DAV (data available) output of the UART is connected to the other enable pin (19) of both 9311s.

Now the data is put on the parallel lines from the UART; this addresses the proper chip for which character you want from it. Now the DAV line from the UART goes low, enabling the second enable pin on the 9311, telling it to decode, as data is on the line and it is addressed. This will put a low level on one of the output pins of that chip, depending on which character is being received by the UART.

The DAV line also ties to the 7404 and the 7400, pin 12. The 7404 inverts the DAV signal and clocks the parallel lines into the transmit part of the UART and also feeds back into the UART RDAV (reset data available line). This will cause the DAV line to go high and inhibit the 9311s. Now the output that went low on the proper 9311 will go high. You can see that this gives us a fast pulse out of the 9311s that is just long enough to trigger the 7473 flip-flop that is tied to that line. Table 2 shows the Baudot code that is related to the parallel lines on the output of the UART.

This SELCAL is designed to work with the ST-5 or ST-6 terminal unit. In the May issue of the *RTTY Journal*, Irv Hoff has a circuit of how to modify the ST-6 to use the UART. All it consists of is the removal of the 2200 Ohm resistor that is connected to the base of the driver transistor MJE 340. Fig. 1 is a copy of this circuit modification. Connect the output of the op amp slicer to the input of the SELCAL pin 4 and then the output of the SELCAL pin 6 to the base of the drive transistor. The input to the SELCAL keys the 2N706, gets inverted by the 7404, and drives the UART through pin 20. The pulses always get through the UART and come out pin 25. This is again inverted by the 7404 and tied to one input of the two input 7400 NAND gate. The other input of this NAND gate is connected to the Q output of flip-flop number 4B. This output is low so that no pulses will get out of the SELCAL and the magnets will be held in the mark hold mode. Transistor Q1 is 2N706 and it monitors the autostart relay in the ST-6. Pin 15 of the SELCAL is connected to the collector of Q5 in the ST-6. When the ST-6 relay is not picked up, you will have a positive 12 volts coming in and this will turn on Q1. The collector of Q1 will go low and hold flip-flop number 4B reset. This puts pin 9 of this flip-flop low and keeps the output and gate 7400 from passing any data to the keying transistor of the ST-6.

When the ST-6 autostart relay picks up, the collector of Q5 in the ST-6 will go to negative 12 volts. This turns off transistor Q1 in the SELCAL and the collector of this transistor now goes positive and takes off the reset hold on the number 4B flip-flop. Data will still not get through the SELCAL as the Q output of the flip-flop is still low until it is toggled. You will note that the collector of Q1 was not only holding the reset of flip-flop 4B, but also the reset on flip-flop number 1A through the two 7408 AND gates. Flip-flops 1, 2, 3, and 4 are all connected in series so that the flip-flop ahead of it is holding its reset low and therefore its Q output will be low. When in this mode, no pulses will be able to toggle any of the flip-flops. When transistor Q1 collector goes high, it removes the reset from flip-flop number 1A. The DAV line from the UART cannot pulse the 7490 counter as it cannot get through the 7400 NAND gate, because flip-flop 1A is holding one of the gates low. On the reception of the first FIGS character, flip-flop 1A gets toggled, the Q output goes high, and now will let the DAV line toggle the counter. The Q output also removes the reset from flip-flop 1B, enabling it to be toggled if the next character is an A. The Not Q output of flip-flop 1A is tied back to the K input and prevents it from being toggled anymore if you send another FIGS. It also removes the reset on the 7490 counter so that the pulses from the DAV line will now increment the counter each time the DAV line goes high. Now follow the chain down the flip-flops and you will see that each character in the string of FIGS A, S, I, A, O, and U will toggle flip-flops 1A, 1B, 2A, 2B, 3A, 3B, 4A, and finally 4B. Flip-flop 4B will turn on the LED, showing you the SELCAL is active, and puts a positive on the 7400 NAND gate, allowing the data to get out of the SELCAL, key the ST-6 driver transistor, and print on your machine on the very next character after the U.

Let's go back to the counter. The 7490 counts the characters that come in after the FIGS is received. This is

so that you must make ASIAOU in six characters or the whole chain of flip-flops gets reset via pins 8 and 9 of the counter, through the 7400 NAND gate and the two 7408 AND gates. You must now start all over with the FIGS to get the chain going again. You must send these 7 characters in a row and in the proper sequence in order for the SELCAL to operate. If it were not for the counter, the chain would sit there and just wait for the characters to come through. Whenever it did sense these seven in sequence (even though you had hundreds of characters in between the valid ones), it would turn on. The NE555 timer is just set up for a clock for the UART. It is adjusted for 32 times the baud rate that you want to receive and then flip-flop 5A divides it by two so that it is a symmetrical clock pulsing the UART. The UART wants to get pulsed 16 times the baud rate you are receiving. I run my machine at 100 wpm or 75 baud. 75 times 16 is 1200, and that is my clock frequency at the UART. The simple little power up circuit using diode D1, resistor R4, and capacitor C3 insures that every time I turn the power on the SELCAL, it will reset all the flip-flops. The way it works is that when power is first turned on, all the gates and flip-flops will come up to power before the gate on pin 5 of the 7408 AND gate. This is due to the fact that the capacitor tied to this pin is short circuited until charged and will hold this pin low long enough to reset the flip-flops. You can fool this circuit if you turn the power off and then on again before the 100 uF capacitor has a chance to discharge. Once the SELCAL is turned on, it will not shut off until you turn the power off, push the reset button, or the ST-6 autostart relay drops out. Any one of these will reset all the flip-flops and now you will have to do the whole thing all over again.

A friend of mine asked me if I could come up with a circuit like this that could be easily changed to any 7 characters you wanted, be simple, and above all, be reasonable in price. I looked up the price of all the chips and came up with a fantastic price for everything (including the UART, resistors, and capacitors) — less than $35.00. This does not include the power supply or the board to mount the chips and the sockets for them. I hope to lay out a PC board and make it available for somewhere around $8.00, depending on my costs. The power supply needs a good regulated 5 volts at 300 mA and negative 12 volts at 10 mA. I am sure this will not strain any power supply that you are using for your ST-6. This circuit can be expanded to any amount of characters that you would want by simply adding flip-flops and changing the counter to what you would want to count. A turn-off of 4Ns is incorporated by switching in the other flip-flops and separate counter so that when you get four Ns, you pulse the reset and turn off the chain of flip-flops. I am sure that this circuit will save many rolls of paper that get tossed out of your machines when you are in the autostart mode and not home and some CW station happens to get your machine going with line feeds. I monitor the Navy Marine Corps MARS frequencies and was shocked one time when I came home from work and heard a RTTY station just sending out test pulses; every one of them to my machine was a line feed. I must have

Fig. 2. ESB-1. Parts list: 1 — UART; 2 — 9311/74154; 1 — 7400; 1 — 7404; 1 — 7408; 7 — 7473; 2 — 7490; 1 — 555; 2 — 2N706; 3 — 1N914; 1 — LED.

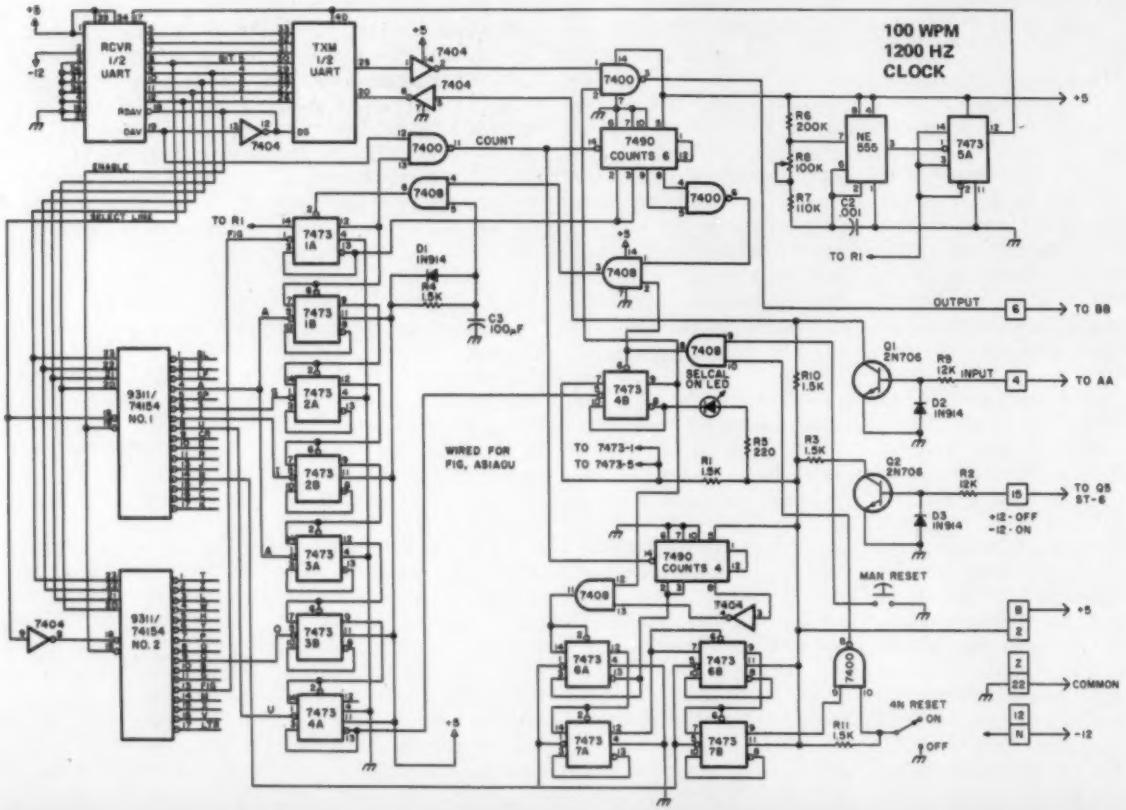

Table 2. Truth table, 5 bit TTY code.

Bit 5	4	3	2	1	Character	Bit 5	4	3	2	1	Character
L	L	L	L	L	= BLANK	H	L	L	L	L	= T
L	L	L	L	H	= E	H	L	L	L	H	= Z
L	L	L	H	L	= LF	H	L	L	H	L	= L
L	L	L	H	H	= A	H	L	L	H	H	= W
L	L	H	L	L	= SPACE	H	L	H	L	L	= H
L	L	H	L	H	= S	H	L	H	L	H	= Y
L	L	H	H	L	= I	H	L	H	H	L	= P
L	L	H	H	H	= U	H	L	H	H	H	= Q
L	H	L	L	L	= CR	H	H	L	L	L	= O
L	H	L	L	H	= D	H	H	L	L	H	= B
L	H	L	H	L	= R	H	H	L	H	L	= G
L	H	L	H	H	= J	H	H	L	H	H	= FIG
L	H	H	L	L	= N	H	H	H	L	L	= M
L	H	H	L	H	= F	H	H	H	L	H	= X
L	H	H	H	L	= C	H	H	H	H	L	= V
L	H	H	H	H	= K	H	H	H	H	H	= LTRS

rolled up 50 feet of paper off the floor back on to the spool. My wife would not go near the machine for a while, as she thought the dumb thing was going to blow up. This circuit should make autostart stations feel a bit more at ease knowing that their machine is not going to print unless it hears their call-sign or any other combination of 7 characters that they want to choose. ■

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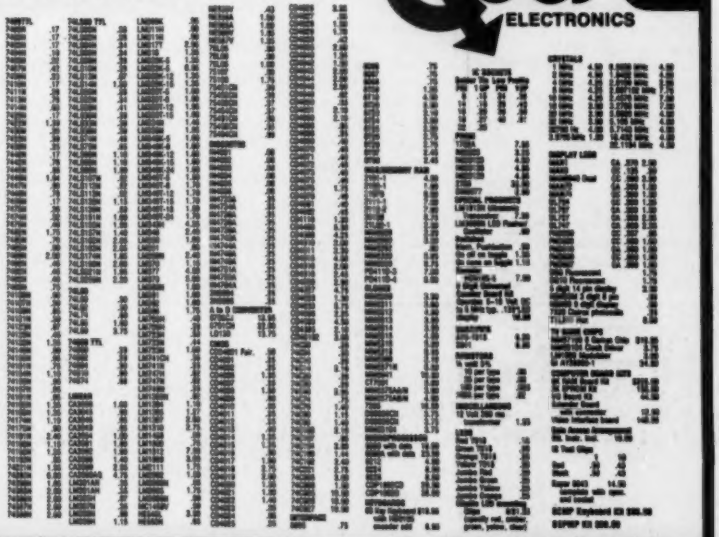

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Corrections

I read the article "Have You Used a Triac Yet?" in the October '76, *73 Magazine*.

You seem to have conveyed the wrong notion of holding current.

This current is *not* a gate current. It flows from anode 1 to anode 2.

Once the gate current has triggered anode-anode current, one could cut its gate current to zero (open circuit) and anode current would continue to flow.

The only way to stop it is to increase the resistance in series with the anode-anode supply, until the current flowing drops below a certain critical value. *This is the holding current.*

More usually, one removes the supply voltage by using an ac or a pulsing dc source.

Michael Murphy VK6ZCX
Wembley Downs
Western Australia

I've noticed a few corrections which should be made to my article ("Build a Counter for Your Receiver") in your October, 1976, issue. In Fig. 2, the output of the 8T98B should be connected to the following input and the 1k resistor, but not to ground. In Fig. 8, the emitter of the first HEP15 should be connected to the junction of the 2 1500 pF capacitors, but not to its base. The connection dots indicating +5 V connected to pin 14 of two of the 7490s should be removed. Relative to the power supply design shown in Fig. 9, I found that removing about 7 feet of wire from the secondary of the recommended power transformer allowed the regulators to run much cooler. This seems to be an ideal way of obtaining low cost power transformers for home computers.

Jack Regula WA3YGJ
Freeville NY

Please note the following corrections to "Mobile Smokey Detector" (Holiday, 1976):

1. In Fig. 2, the circuit diagram, the resistor connected to pin 14 of the CD4011A integrated circuit is 100 Ohms. It is a decoupling filter.
2. The location of the detector crystal and modulator diode are in conflict in Figs. 2 and 3. The locations in Fig. 3 are correct.
3. The tips of the diodes shown in Fig. 3 appear to touch the inside wall of the circular waveguide, which is correct, but part of the drawing was left off, to indicate that sleeves which make good electrical contact should be installed. These may be constructed from brass pipe obtained in model shops. The pipe has an inside diameter which tightly slides over the diode tips.
4. Please do not plan on getting on the X band frequency or, for that matter, on any frequency without a license. The implication that a license might not be required was the editors', not W1SNN's.
5. Parametrics 400075 Schottky diodes may be purchased from Parametrics, Inc., of Winchester, Massachusetts, or Microwave Associates, of Burlington, Massachusetts. Both of these manufacturers have a minimum order requirement, and may not be too sympathetic to selling pairs of diodes. K1NAY, 25 Westfield Road, Natick, MA 01701, has a sales schedule for pairs of these diodes, which may help. 1N23E diodes will work well in both places, but care must be used in biasing and with the switching levels. Use them as a last resort.

Stirling M. Olberg W1SNN
Waltham MA

The first two articles read after scanning the January, 1977, issue were: "Dirt Cheap Regulation," and "Behavior Mod for the HM-102."

In the first article, the author did not follow his own parameters for criteria when he loaded the supply to 1.2 A for 30 mA residual ripple. With any kind of Beta on the two transistors, the regulation should be better than that. Also not mentioned is that the emitter of T1 has residual ripple (output ripple) which is in phase with the base ripple and so is degenerative, further reducing ripple. The C to reduce ripple in the regulator would be far more effective and smaller (cheaper) if placed at the base of T1, instead of as illustrated before the isolating resistor. Of course, if current limiting is also used, some isolation from T1 base would be advisable after C. This convenience and security can be easily secured by a small value resistor in the negative return lead and an NPN transistor with collector connected to T1 base. Also, it might be mentioned, since we are going to the junk box, that zeners and conventional diodes, both germanium and silicon, can be combined for precise values. The literature also provides the information so that the combination will be less temperature dependent.

As for the fine article on modifying the HM-102-1, there is an error in the drawing. Some of the boys, quick with the soldering iron, might proceed at once, looking at the manual and the drawing. The new lead (white) to R4 does not go to pin 5 of SW2, but remains at pin 4. The red lead should be shown from B to pin 5.

Frank C. Ruland
Oklahoma City OK

With regard to my article "Digital Autopatch" (April, 1977), I would like to point out the following:

1. "Touchtone" is a registered trademark of AT&T.
2. In the caption for Fig. 6, the following should be deleted: "R5, Q3 not used. Highest R = 31; highest C = 20".
3. On the third page of the article, column 1, line 10, should read, "to 7. The 74193 loads a '1'".
4. In Fig. 9(b), "17" should read "L1". Please note that the configuration for the 2N3904 transistor was inadvertently omitted (although the pads are shown).

E. E. Buffington W4VGZ
Burlington NC

Ham Help

The Laundale Amateur Radio Club, a newly formed youth oriented organization, seeks your assistance in acquiring equipment. We need all types of usable equipment (VHF antennas, keyers, matchboxes, etc.) to get our members on the air. We are lacking funds, so a nice low price tag or a donation would be well appreciated. Help a young ham and send your info to:

Dennis J. Gazak WA3SZD
President, Laundale ARC
321 Stevens Street
Philadelphia PA 19111

Will be glad to help any County Hunter with Dukes County, Mass. during 1977 on 80-40-20. Just drop me a note for a sked.

Duncan Kreamer W1GAY
Box 637
Vineyard Haven MA 02568

I have an HW-16 CW transceiver and would like to operate it on the twenty meter CW band. I have heard there is a modification to change the 15 meter portion to the 20 meter portion, but am unable to find any info on it. Can someone help?

Alvin S. Koslofsky WB2CUP
2105 Rockaway Parkway
Brooklyn NY 11236

Wanted: a small lightweight QRP transmitter for 40 meter CW operation, 12 V dc or ac line okay. Write giving full particulars. Needed by June.

James Kates WB8TCC
360 North Hubbard Hall
Michigan State University
East Lansing MI 48824

I would like to get in touch with someone who knows his stuff on the Central Electronics 100 V transmitter. I'd like to try for repair advice by mail, or I'll phone. Alternatively, is there a commercial repair outfit who could handle it within a reasonable drive of North Jersey? Thanks much for any help.

Joe G. Koosman K2GFH
54 Brookside Terrace
North Caldwell NJ 07006

Could you show a circuit diagram of an 80/40 meter receiver suitable for CW communications? It should have selectivity.

Benjamin Diaz, Jr. WB4VEZ
2870 SW 123 Ct.
Miami FL 33175

Try "Novice Q & A" for the receiver tips, and January, 73, pg. 160, for a simple transmitter. — Ed.

I would like to appeal to your readers for technical advice on converting a Hammarlund FM 50a commercial transceiver to 2 meters. I am especially wondering about the 1st local oscillator in the receiver section.

Steve Royer
114 Sunset Pt.
Greenville FL 62246

Need help in designing and finding parts (ICs, etc.) for a solid state crystal-calibrated signal generator 3-30 MHz and FM 88-108 MHz and crystal-controlled 19 kHz, 4.5 and 10.7 MHz.

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RIPPED OFF: Motorola VHF-FM Transceiver, "Modar Triton" Series, Model #D23ABA1820A, modified; Serial #LM049T. Serial Numbers & Model Numbers are engraved on the back and inside; also name "W. L. Call," amateur callsign "WA4ZSJ," and driver's license number "KY C-400-887-553-475-6." Unit is distinguished by faded white case with word "SALVAG" scratched into top of case. Inside contains custom modifications. Value $450. Contact William L. Call WA4ZSJ, Box 2740 University Station, Murray KY 42071.

TAKEN: Swan Model 400 transceiver, s/n 100801, grey case, from my car on the morning of February 10, 1977, at my office, City of Industry, California. Neither the 406 tuning head nor power supply were taken; hence, the thief or whoever buys the transceivers might be looking for such items. Ira Bechtold, 17137 East Gale Ave., City of Industry CA. Refer any info to Sheriff's Dept., Detective Bureau, (213) 330-3322, file no. 577-02681-1424-696.

HIJACKED: Clegg FM-3 2 meter transceiver, s/n 750117. Passenger window was smashed on my locked car while at a restaurant in Lowell, Mass., on January 15, 1977. This unit has engraved on upper rear the markings A977. Emile T. Timko W3OHX, 5 West 17th Street, Hazleton PA 18201.

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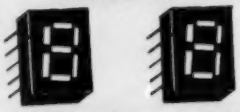

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7403	.17	7476	.35
74H04	.25	7480	.45
7404	.17	7483	.76
7406	.25	7485	.89
7408	.17	7486	.35
7409	.17	7490	.71
7410	.17	7491	.71
7411	.25	7492	.71
7413	.45	7493	.67
7420	.17	7494	.90
7421	.17	7495	.71
7423	.35	7496	.85
7425	.27	74100	.96
7426	.25	74121	.31
7427	.17	74123	.81
7430	.25	74125	.44
7432	.30	74141	.71
7437	.35	74145	.97
7438	.35	74151	.71
7440	.17	74153	.81
7442	.60	74154	.97
7443	.60	74161	.91
7444	.65	74163	1.05
7446	.85	74164	1.05
7447	.81	74174	.91
7448	.81	74175	1.40
7450	.20	74180	.78
7451	.17	74181	2.25
7453	.17	74191	1.20
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74LS10	.25
74LS11	.32
74LS20	.31
74LS21	.33
74LS22	.33
74LS27	.30
74LS30	.31
74LS32	.33
74LS37	.40
74LS38	.35
74LS74	.49
74LS90	.85
74LS132	.90
74LS138	.89
74LS139	.89
74LS155	.90
74LS157	1.00
74LS162	1.39
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CD4011	.16	CD4049	.35
CD4012	.16	CD4050	.35
CD4013	.29	CD4051	.90
CD4014	.75	CD4053	.90
CD4015	.75	CD4056	1.00
CD4016	.29	CD4058	.90
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LM3900	.30
LM710	.25
LM711	.25
LM723	.40
LM748	.25
NE555	.35
NE556	.95
NE565	.95
NE566	.95
NE567	1.10
1458	.49
RCA 3043	.75
75491	.25
75492	.25

60 Hz Crystal Time Base Kit

— Kit enables a MOS clock circuit to operate from a DC power source. Ideal for car, camper, van, boat, etc.

60Hz output with an accuracy of .005% (typ.) Low power consumption 2.5 ma (typ.). Small size will fit most any enclosure. Single MOS IC oscillator/divider chip 5-15 volts DC operation.

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TELENETICS TOUCH-TONE DECODER

Telenetics Model 7516-01 (patent pending) is a Touch-Tone Decoder housed in a half cubic inch, 32 pin dual-in-line package. Tone signals comprising the sixteen telephone standard 2 of 8 codes are received, processed and output as logic levels on discrete pins.

Two data output formats may be pin selected: Discrete *1 of 16 or Binary coded decimal* (BCD). The BCD outputs, digits 0 through 9, appear as five parallel lines (8, 4, 2, 1 & Clock) in a positive true logic configuration. The six non-decimal characters appear on discrete pins in either output mode.

Additional convenience outputs are provided: *An ANY DATA* that goes true in the presence of any valid input, and a continuous *10 kHz Clock* derived from an internal quartz crystal. Peak limited square wave signals from the band separation filters and envelope detected speech and signal pulses are provided as are an input buffer amplifier and ½ voltage reference outputs.

The 7516-01 combines multi-layer thick film hybrid techniques with a proprietary P-MOS large scale integrated circuit. All are silicone encapsulated in an RFI shielding ceramic and metal case. Tenth inch (0.1) pin spacings on .600 inch row centers permits plug-in installation in standard I.C. sockets.

Model 7516-01 **$115.00**

Order by telephone or mail

KA Electronic Sales

1220 Majesty Drive Dallas, Texas 75247
(214) 634-7870 Texas Wats (800) 492-2842

TELENETICS

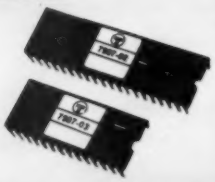
TOUCH-TONE ENCODER

The Telenetics 7603-01/02 a self contained Touch-Tone Encoder used to generate standard telephone dual-tone multiple frequency (DTMF) signals. Ideal for manual data entry. Signaling can be affected in 3 ways: standard keyboard (using 1 of 16, 2 of 8, or parallel binary coding); access from active memory; or a hardwired 4 or 8 digit numbers sent upon ANI START command. Digital input/output terminals can be interfaced to TTL or MOS.

Analog tone out compatible with telephone system. In dash-01 unit high and low band tone out are of equal power, in the dash-02 the high band frequencies are at 3 dB greater than the low band to compensate for roll-off in long lines.

Models 7603-01/02 each **$24.25**

TELENETICS

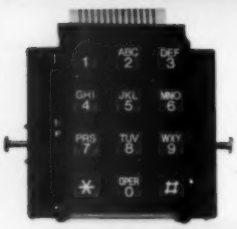


SOLID STATE ANALOG SWITCHES

The Telenetics 7507 CMOS Switch family of components is based on an MOS circuit with 16 switches, drivers, latches and decoders on die. The switches are analog transmission gates with a maximum ON resistance of 60 ohms, and maximum spread of 5 ohms among the 16 switches in any unit.

Increased flexibility is provided by three versions of the basic switch: the 7507-01, sixteen independently addressable and latchable single pole-single throw switches; the 7507-02 consisting of eight double pole-single throw switches, and the 7507-03 which is configured as a four pole-four position switch.

Models 7507-01/02/03 each **$23.00**

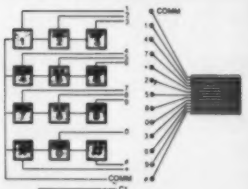


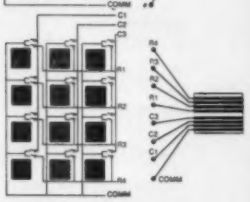
TELENETICS KEYSWITCH

The Telenetics 7635-01/02 Keyswitch exactly duplicates the familiar telephone touch-tone® keyboard, it employs a sealed polyester film contact matrix tested to over 10 million key operations. Key travel and operating force duplicates the standard telephone keyboard. The keyswitch provides economical and efficient mounting facilities for installation of electronics, thus allowing compact packaging of input subsystems.

Models 7635-01-02 each **$9.00**

7635-01 Keyswitch
one of twelve output code





7635-02 Keyswitch
two out of seven output code

TELENETICS

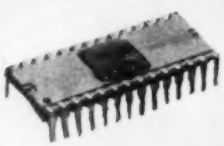
C-MOS MULTIPLEXERS

The Telenetics 7508 Multiplexers are based on an MOS circuit with 16 switches, drivers, latches and decoders on die. The switches are analog transmission gates with an ON resistance of less than 60 ohms, and maximum spread of 5 ohms among the 16 switches in any unit.

This multiplexer is supplied in two versions: the 7508-01, a one by sixteen position unit and the 7508-02, a two by eight position unit for balanced switching.

Models 7508-01/02 each **$20.00**

TELENETICS



ADDRESS SELECTOR

The 7511 Address Selector provides an output in response to a cumulative total number of sequential inputs, if-and-only-if the inputs are entered in a fixed order within a maximum time interval. Out-of-sequence inputs, and/or too long an interval between successive inputs, resets the 7511 and no output results.

Model 7511-01 **$17.00**

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No other clock at any price has all these features:

MINI GRANDFATHER CLOCK KIT

$39.95
(order MG-01)
Case NOT included
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(order MG-01/A)
Completely assembled!
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We offer a beautiful solid hard wood case in either ash or walnut with front ruby filter. Designed and cut specifically for the mini grandfather clock kit.
Unfinished Case – $14.95
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Please specify type of wood desired. Case is shipped unassembled.

This quality time piece will catch the eye of everybody who walks into your house! It will be the most unique item on your mantle or bookshelf.

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- Chimes the hour (ie: 3 times for 3 o'clock
- Adjustable volume tone and sustain on the chime.
- LOW COST
- Complete with all parts including transformer & Speaker

WE BACK YOU UP!
Bullet will repair any kit we have ever sold for 20% of original purchase price to cover handling. (Warranty void for improper soldering techniques.)

AUTOMATIC TIME-OUT CIRCUIT
For use with the US-01 or any other application. Provides a 17 second entry delay and then energizes your alarm for approx. 10 minutes; rearms itself. Will source up to 200ma to drive a relay. All components & PC board.
$3.95

ULTRASONIC SENDER-RECEIVER KIT

A special buy on a high quality ultrasonic transducer allows us to offer this kit at a super price. Gives you the basics to build INTRUSION ALARMS, MOTION DETECTORS, REMOTE CONTROLS, ECHO RANGING, etc. All components with drilled & plated PC Board. Will cover up to 400 sq. ft. Requires 12-15VDC @ 80 ma (not supplied). Order model US-01.

$19.95

WARBLE ALARM KIT

Thousands of these are being used in scores of applications. Gives a LOUD two tone scream of 10 watts (pulsed) power. Requires 6-15VDC@ 800ma & 4 or 8 ohm speaker. (spk. not supplied) **$2.50 includes all components & PC Board**

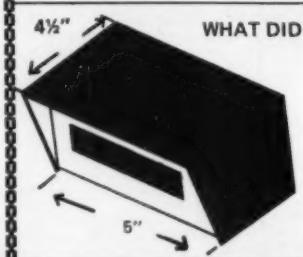
THE PS-12/A IS THE BEST POWER SUPPLY KIT ON THE MARKET FOR *49.95. PERIOD!

$49.95

CHECK THESE SPECS:
- 3 to 16 volts and 15 to 30 volts (2 ranges)
- Adjustable fold back current limiting from 4 to 15 amps.
- 10 amps continuous, 15 amps with fan cooling.
- Regulation better than 150mv from 0 to full load
- Ripple less than 200mv @ 10 amps
- Short circuit protection

LOOK WHAT YOU GET:
- 11 pound heavy duty transformer
- Two 6" 60 watt heatsinks
- All resistors, caps, etc.
- Large computer grade filter cap
- IC regulator, power transistors and 15A bridge rectifier.
- Quality plated and drilled PC board

Price does not include case, meters, or jacks.
*** Add $3.70 for UPS shipping.**



WHAT DID YOU DO WITH YOUR $9.95 LED CLOCK?

Put it in a quality custom metal shadow front case.

- Black baked enamel wrinkle finish
- Pre-punched front slot
- Ruby filter
- L brackets & hardware for mounting your clock

$4.75

FIRED UP!
Our CDI Kit will give your car that extra spark it needs to burn fuel more efficiently. A special buy allows us to sell the complete kit at a low, low price. $9.95
Includes: Special toroid transformer, drilled & plated PC board, all components, and complete instructions. (Heatsink and case NOT provided.)

$9.95

THE DOOMSDAY ALARM
$8.50

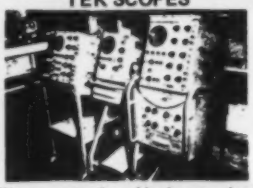
Four independently adjustable oscillators are sequentially mixed and disabled by a counter circuit pulsing at a rate that you set. The sound combinations are endless and the effect is amazing. Sounds straight from the Twilight Zone. Complete electronics with plated PC board. Requires 6 to 15 volts DC @ 800ma. 10 watts (pulsed) @ 8 ohms and 12 volts. Order: DA-01 $8.50

SMILIN' JACK ..... YOU NEVER HAD IT SO GOOD!
Separate 24 hour real time clock and up to 24 hours elapsed time displayed independently on the same set of six .4" LED readouts. Clock has presettable alarm with 10 minute snooze. Timer has reset, hold and count functions. Full noise and overvoltage protection. Because of the many options and mounting variations the kit is sold less the case and switches.

MK-03 **$26.95** 9 to 14 VDC

Will fit inside standard aircraft instrument case.

TEK SCOPES



We are constantly making huge purchases of used test equipment, and we don't buy unless we buy right . . . which means you the customer recieve the lowest possible prices. Here's a list of TEK oscilloscopes presently in stock. All are used, but we check the trace etc. to be sure that they are in good working order.

All plug-ins sold separately

"*" indicates scopes with dual trace capability. Those without "*" do not require plug-ins.

TEK Md. 541A *	DC to 33MC. $375.00
TEK Md. 545A *	DC to 33MC. $495.00
TEK Md. 535 *	DC to 11MC. $275.00
TEK Md. 555 *	DC to 33MC. $595.00
TEK Md. 531A *	DC to 15MC. $250.00
TEK Md. 315D	Compact scope, DC to 10MC $195.00
TEK Md. 517A	Hi-speed scope DC to 20MC $195.00

All scopes shipped via truck, freight collect to you. To receive a **complete list of test equipment**, send for our free catalog.

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Type C/A DC to 24 MC Dual Tr. $150.00
Type 53/54C DC to 24MC DuTr $135.00
Type H DC to 15MC $50.00
Type 80 Vertical Plug-in for coupling 580 series. $20.00
Type 60 (2A60) DC to 1MC $30.00
Type 53/54B Wide Band Hi-Gain . $35.00
Type 53/54K Fast Rise Plug-in. . . $40.00
Type 53C DC to 24MC DuTr . . $125.00
Type L Fast Rise. $65.00

All equipment above subject to prior sale.

INPUT/OUTPUT TERMINAL

A great place to start for building a microprocessor. These units were part of a comlex computer system. The terminal contains: keyboard; CRT; drive circuits; ASC11 output; and a complete 128 page technical manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. (Character generator was part of a separate control section which is not supplied. The terminal can be used when modified using character generator LSI chips, such as the 2513, 2516 or other such IC's).

The keyboard is a 50 key alpha-numeric (and others) block keyboard, with ASC11 output. Display capactiy is 768 (12 lines of 64), 384, 256, 128 and so on, depending on character size desired. The character size may be adjusted from approximately typewriter size up to ¼".

The viewing screen of the CRT utilizes a high contrast, low persistence, emerald green phosphor. Each character is composed from a 5 x 7 dot pattern, registering clearly and sharply against a dark background. Controls provided include: on/off; brightness; focus; and character height.

Great as a microprocessor input & output device. The display stations are used, removed from airline reservation systems, hotel reservation systems, stock exchanges, etc. Sh. Wt. 35 Lbs.

5NB60336 . . . . . ~~$49.50~~

Special 73 reader price . . $39.50

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LOUDSPEAKER COMPONENT SPECIAL

We have made an excellent purchase of an excess inventory of a local manufacturer's speaker systems. Although we are not allowed to mention the mfr. name, the spec's should make it self-evident. The woofer is a 12" free-edge (acoustic suspension) unit, with 2" voice coil and a No. 2 magnet. The midrange is a 5" sealed back speaker and a 3½" flare dome tweeter for best frequency dispersion. Crossover between woofer and mid-range is by an R-L-C network, while high frequency is by an R-C network. Balance controls are included for both mid-range and tweeter. Plans for a suitabel enclosure are provided. The level controls provide frequency response to suit room acoustics, with realsim that will delight even the most critical listener. Response: 25 to 20K÷ Hz. Power: 65 watts RMS. Impedance: 8 ohms.

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We have over a million transformers in stock! The list below includes some of our most popular transformers for use in power supplies. This is only part of our vast selection. All primaries are 115 VAC.

Sh. Wt.	Order No.	Volts	Amps	Price
6	5H00013	18	5	
		17	5	$8.50 ea
		10	8	
10	4EX245	24	5	$4.00 ea
10	X045 *	27(ct)	5	$7.00 ea
10	6H60528	15	15	$8.00 ea
15	6H60529	24(ct)	5	
		24 or		
		32	3	$10.00 ea
6	6G60139	24	2	
		12	2	
		12	2	$6.00 ea

*Ferro-Resonant type.

CONFERENCE CALLER KIT

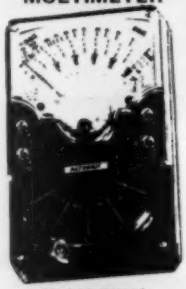
Phone not included

Unique kit of parts allows you to connect up to 5 lines through switching and a special transformer. Unit will allow you to engage as many as 5 persons . . . no no matter where they are . . . in the same conversation just by dialing a number and flipping a switch. It's that simple, that quick. The "Conference Calier" can be attached to any multiple line telephone. There is no additional outside power required and no interference with normal phone service. Case not supplied.

Kit includes a special transformer, switches, cable, solid state parts and you supply the case. Complete with instructions and data.

Sh. Wt. 8 Lbs. . . . 7C70043. . . $18.88

MULTIMETER



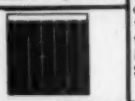
20,000 OHM/ VOLT - MILLIAMMETER

Precision engineered quality multimeter designed for accuracy in the field or on the technician's bench. Easy-to-read heavy black numbers carefully scaled for quick exact reading. Precision 250uA D'Arsonval movement, crystal clear high impact plastic front takes rough treatment and gives full scale view. Popular swinging-lever nylon range selector switch allows easy selection of ranges and stands up to continuous use. Dimensions: 4¾" high, 3" wide, 1¾" deep. Other outstanding features include a heavy duty bakelite case. Complete with test leads, battery, case and instruction manual.

Specifications:	Sh. Wt. 1 Lb
DC VOLTS	0-5-25-200-500-1000 V (20,000 ohms per volt)
AC VOLTS	0-5-25-100-500-1000 V 10,000 ohms per volt)
CURRENT	0-50uA, 0-5-50-500mA
OHMS	0-6K-600K-6Meg.
DECIBELS	-20 db to + 62 db, 5 ranges

7VL70026 Special!. . $22.95

SOLAR CELLS



Silicone cell with an output of 0.5 volts, 30 ma. These should be good for those who wish to experiment with solar energy but don't want to invest their life savings. Try 'em and find out what it's all about. At these prices you can't lose!

Sh. Wt. 2 oz. . . . 7MI70025 . . . .$1.00
7 for $5.00. . . 7MI70025 . . . $5.00/7

DRINK MIXER KIT

A real old-fashioned type like the kind at the local drug store back in the 1950's, except that these are brand new parts. Through a lucky purchase we have obtained some new parts of a drink mixer. It is complete but for the top cover, but you can make your own or operate without it. Evidently the manufacturer sold this line out to another and the tops got lost. Now you can build up a $20.00 mixer for under $5.00. Kids love 'em, order one today! Kit includes motor, mixer, screws, stand, line cord, switch, and 16 oz mixer cup. . . . . .Sh. Wt. 5 Lbs.

7M370053 . . . . . .$4.88

ALSO: Spare Mixer Cup for above,

Sh. Wt. 8 oz. . . 7M370054 . . $0.80 ea.

HEAVY DUTY BATTERY CHARGER KIT For Automotive Batteries

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Sh. Wt. 16 Lbs. . . 7C70005 . . .$19.50
3 for $55.00. . . .7C70005. . . $55.00/3

C.B. LITE

C.B. fans will love this one: it's a transmit and modulation lighted indicator kit. Size is 1¾" x 2" x 1⅛" deep, which makes it small enough to fit anywhere and large enough to add a personal touch to the illuminated face. Check these features:

† You get a transmit and modulation check each time the mike is keyed, lights up to indicate output power, flashes to indicate modulation strength.

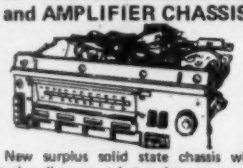
† Simple connection to antenna jack, complete instructions included.

† Kit includes light sockets, fresnel lens/faceplate, vinyl letter set, lamps, wire and instructions.

Sh. Wt. 3 oz. . . 6B60500 . . was ~~$7.95~~

Special 73 Reader Price. . only $2.25

AM-FM STEREO RECEIVER and AMPLIFIER CHASSIS



New surplus solid state chassis with push-pull power tab transistor power on the audio output amplifier. Has a stereo "bull's eye" on the tuning needle that lights up when a stereo station is tuned in. Has provisions for a 4-speaker system built-in, with RCA type jacks for front and rear speakers (L&R), plus cables with plugs for phono and tape inputs. Push-button switches are used to select phono, tape, AM and FM. Unit has slide controls for volume, balance, base and treble. Complete with knobs, dial face (marked and illuminated with AM & FM scales) and line cord. Looks good for custom building a stereo console, mounting in to a wall or whatever. All it needs is a case, and at our low price these Philco stereos will not last long! Size: 15½" x 5" high x 4½" deep. Just add 2 (or 4) speakers for fine stereo listening.

SPECIAL PRICE for 73 READERS!

Sh. Wt. 7 Lbs. . . . 6Z60213. . . .$29.88
3 for $80.00. . . . 6Z60213. . . $80.00/3

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B&F is publishing a limited edition Clean-Sweep Sale catalog: for a limited time we will cut prices on thousands of items. Don't miss out on this unprecedented **Clean-Sweep Sale**, brought to 73 readers (our prefered customers!) by the new management at B&F.

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A220-VPK VERT POLE KIT FOR TWO A220-11 ..... 23.95
A147-SK STACKING KIT FOR TWO 147-11 ..... 15.95
A147-VPK VERT POLE KIT FOR TWO 147-11 ..... 29.95
A449-SK STACK KIT FOR TWO A449-11 ..... 15.95
A449-VPK VERT POLE KIT FOR TWO A449-11 ..... 23.95
A144-10T 10EL OSCAR 145 MHZ 34.95
A144-20T 20EL OSCAR 145 MHZ 54.95
A432-20T 20EL OSCAR 430-436 MHZ 49.95
A147-MB TWIST MOUNT BOOM AND BRACKET 15.95
A50-5 5 EL BEAM 6 METER .. 49.95
ATB-34 4EL TRI-BAND 10, 15, 20 ..... 239.95
AFB-1 BALUN ATB-34 FERRITE 1-1 ..... 14.95
CR-1 RINGO CB ANTENNA .. 29.95
MS-2 3 BAND HI, LOW, UHF SCANNER MONITOR ANTENNA ... 24.50
LAC-2 LIGHTNING ARRESTOR SO-239 EACH END 4.50

●HY-GAIN
14AVQ/WB VERTICAL 10-THRU-40 ..... 67.00
18AVT/WB VERTICAL 10-THRU-80 ..... 97.00
14RMQ ROOF MOUNT KIT 14AVQ, 18AVT 24.95
18HT HY-TOWER VERTICAL 10 THRU 80 ..... 259.95
TH3JR 3EL 10/15/20 BEAM 750 W PEP 144.50
TH3MK3 3EL 10/15/20 BEAM 2KW PEP 199.50
TH6DXX 6EL 10/15/20 BEAM, 2KW PEP 239.95
203BA 3EL 20 METER 149.95
402BA 2EL 40 METER 199.95
153BA 3EL 15 METER 79.95
64B 4EL 6 METER BEAM 45.00
244 HY QUAD, 2EL QUAD 10/15/20 ..... 219.95
DB10/15A 2EL 10/15 BEAM . 149.95
28DQ TRAP DOUBLET ANTENNA 40/80 ..... 49.95
5DBQ TRAP DOUBLET ANTENNA 10 THRU 80 ..... 79.95
270 MOBILE 2 MTR 6 DB GAIN FIBERGLASS 3/8 X 24 STUD . 39.95
271 BASE STATION MOUNTING BRACKET 270 ..... 4.95
BN-86 FERRITE BALUN 10-THRU 80 ..... 15.95
LA-1 LIGHTNING ARRESTOR, HEAVY DUTY PL-259 CONNECTORS 34.95
C1 CENTER INSULATOR FOR DOUBLET 5.95
E1 END INSULATOR FOR DOUBLET PAIR 3.95
269 2 MTR RUBBER DUCKIE ANTENNA 5/16 X 32 BASE 7.00
274 2 MTR RUBBER DUCKIE ANTENNA BNC BASE 9.00
275 2 MTR RUBBER DUCKIE ANTENNA PL-259 BASE 7.00

●MOSLEY
CL-33 CLASSIC 3EL 10/15/20 BEAM 224.00
TA-33 JR 3 EL 10/15/20 BEAM 145.00
TA-33 EL 10/15/20 2KW PEP BEAM 198.00
TA40KR CONVERSION KIT, ADD 40 MTR TO TA-33 ..... 88.50
DI-2 VERTICAL GROUND PLANE 2 MTR 1KW 30.00
SWL-7 SHORTWAVE TRAP DIPOLE 41.25

●MINI-PRODUCTS
HQ-1 HYBRID QUAD BEAM ANTENNA BANDS 6, 10, 15 & 20 MTRS, ELEMENT LENGTH 11 FT., BOOM 4½ FT. TURNING RADIUS 6'2" 1200W PEP, F/B RATIO 12 TO 17 DB, IDEAL BEAM FOR SMALL AREA, WT. 15 LBS 119.50
C-4 VERTICAL ANTENNA 6, 10, 15, 20 MTR. 1200W PEP 52.50

●LARSEN
MM-LM-150 2MTR, 5/8 LOADED 144-174 MHZ MAGNETIC MOUNT ANTENNA WITH RG-58/U COAX 38.50
GC-LM-150 2 MTR 5/8 LOADED 144-174 MHZ GUTTER CLAMP MOUNT ANTENNA WITH RG-58/U 38.50
AMB-150K 2 MTR 5/8 LOADED 144-147 MHZ TRUNK GUTTER MOUNT ANTENNA WITH RG-58/U 33.00

●DENTRON
SKYCLAW VERTICAL, 40/80/160 ..... 79.50
SKYMASTER VERTICAL, 10 THRU 40 ..... 84.50
80-4VR RESONATOR 80M FOR SKYMASTER 29.50
EX-1 VERTICAL FULL 40 MTR 1/4 WAVE 33 FT, IDEAL VERTICAL FOR PHASING 59.50

●NEWTRONICS
4BTV VERTICAL 10-40 MTRS 99.95
RM-75 RESONATOR ADD 75 MTRS 15.50
RM-75S SUPER RESONATOR 1KW 30.00
CG-144 2 MTR COLINEAR 5.2 DB GAIN 3/8" X 24" BASE 25.50
CGT-144 2 MTR COLINEAR 5.2 DB GAIN TRUNK LIP MOUNT ... 41.30
DCX DISCONE ANTENNA 40-700 MHZ 13.00
G6-144A REPEATER APPROVED 6 DB GAIN COLINEAR 2 MTR .. 67.50

●SWAN
TB2A 2EL BEAM 10/15/20 .. 129.95
TB3HA 3EL BEAM 10/15/20 . 189.95
TB4HA 3EL BEAM 10/15/20 . 249.95
742 TRI-BAND 20/40/75 METER MOBILE, ELECTRONICALLY TUNED AUTOMATIC BAND-SWITCHING 500W PEP 79.95
SWR-1A POWER/SWR METER 0-1KW 3.5-150 MHZ SO-239 INLINE .. 25.95
SWR-3 MEASURE SWR 1:1 TO 3: SWR AT 500 OHMS 1.7 TO 50 MHZ, SO-239 INLINE 12.95
FS-1 MEASURES RADIATED POWER, TELESCOPIC ANTENNA 1.5-200 MHZ 10.95
WM-2000 INLINE WATTMETER/SWR THREE SCALES TO 2000W POWER/SWR 3.5-30 MHZ 59.95
WM-3000 A TRUE PEP SSB INLINE PEAK RMS WATTMETER/SWR TO 2 KW IN RMS OR PEAK BY SWITCHING 79.95
WM-6200 INLINE VHF 50-150 MHZ WATTMETER/SWR TWO SCALES TO 200 WATTS 59.95

●CDR ROTORS
HAM II ROTOR WITH CONTROL 139.50
CD-44 ROTOR WITH CONTROL 119.50
AR-22 ROTOR WITH CONTROL 49.50
8 CONDUCTOR ROTOR CABLE PER FOOT ..... .17

●COLUMBIA WIRE
50 FT ROLL RG-58/U LOW LOSS FOAM SUPERFLEX COAX WITH PL-259 EACH END 7.50
100 FT ROLL RG-58/U SAME AS ABOVE 13.00
50 FT ROLL RG-8/U LOW LOSS FOAM SUPERFLEX COAX WITH PL-259 EACH END 14.00
100 FT ROLL RG-8/U SAME AS ABOVE 24.00
100 FT ANTENNA WIRE NO. 17 BARE COPPERWELD STRANDED 7/25 ..... 3.90

Slep Electronics Co.

P.O. BOX 100, HWY. 441, DEPT. 73E , OTTO, NORTH CAROLINA 28763

WE PAY SHIPPING via UPS or best way on all advertised items to 50 states and APO/FPO on mailable items. Export orders shipping extra. We accept Master Charge, NC residents add 4% sales tax. Phone Bill Slep (704) 524-7519.

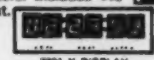
54

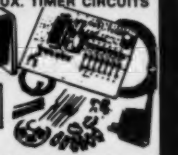
6-DIGIT LED CLOCK CALENDAR KIT

DATE-TIME-SNOOZE ALARM & MORE... KIT 7001

FOR THE BUILDER THAT WANTS THE BEST. FEATURING 12 OR 24 HOUR TIME — 29-30-31 DAY CALENDAR. ALARM, SNOOZE AND AUX. TIMER CIRCUITS

Will alternate time (8 seconds) and date (2 seconds) or may be wired for time or date display only, with other functions on demand. Has built-in oscillator for battery back-up. A loud 24 hour alarm with a repeatable 10 minute snooze alarm, alarm set & timer set indicators. Includes 110 VAC/60Hz power pack with cord and top quality components through-out.





CHOICE OF DIGITAL DISPLAYS

PRINTED CIRCUIT BOARDS for CT-7001 Kits sold separately with assembly info. PC Boards are drilled Fiberglass, solder plated and screened with component layout. Specify for 7001 *B, C or X* - $7.95

KIT - 7001B WITH 6 - .5" DIGITS $39.95
KIT - 7001C WITH 4 - .6" DIGITS & 2 - .3" DIGITS FOR SECONDS $42.95
KIT - 7001X WITH 6 - .8" DIGITS $45.95

KITS ARE COMPLETE (**LESS CABINET**) WITH PC BOARDS, POWER SUPPLY, IC & SOCKET, 16 TRANSISTORS, 9 SWITCHES AND ALL REQUIRED PARTS. ALL 7001 KITS FIT CABINET I AND ACCEPT (OPTIONAL) QUARTZ CRYSTAL TIME BASE KIT # TB-1

6 DIGIT LED CLOCK KIT #850-4

12/24 HR. OPERATION BIG .4" DIGITS 50/60 HZ OPERATION.

KIT INCLUDES
- INSTRUCTIONS
- QUALITY COMPONENTS
- 50 or 60 Hz OPERATION
- 12 or 24 HR OPERATION

6-LED Readouts (FND-359 Red, com. cathode)
1-MM5314 Clock Chip (24 pin)
13-Transistors
2-Switches
6-Capacitors
5-Diodes
8-Resistors
24-Molex pins

Kit #850-4 will fit Plexiglas Cabinet II

$11.95 ea. QTY. 1-5
$10.95 ea. QTY. 6-11
$9.95 ea. QTY. 12 OR MORE

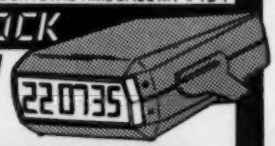
"Kit #850-4 will furnish a complete set of clock components as listed. The only additional items required are a 7-12 VAC transformer, a circuit board and a cabinet, if desired."

PRINTED CIRCUIT BOARD FOR KIT #850-4, SCREEN PRINTED DRILLED AND SOLDER PLATED FIBERGLASS $2.95
MINI-BRITE RED LED'S (FOR COLON IN CLOCK DISPLAY) .... Pkg. of 5-$1.00
MOLDED PLUG TRANSFORMER 115/10 VAC (WITH CORD) $2.50

NOTE: Entire Clock may be assembled on one PC Board or Board may be cut to remote display.

MOBILE LED CLOCK

12/24 HR .4" DIGITS!



MODEL #2001

12 VOLT AC or DC POWERED

- 6 JUMBO .4" RED LED'S BEHIND RED FILTER LENS WITH CHROME RIM
- SET TIME FROM FRONT VIA HIDDEN SWITCHES + 12/24-Hr. TIME FORMAT
- STYLISH CHARCOAL GRAY CASE OF MOLDED HIGH TEMP. PLASTIC
- BRIDGE POWER INPUT CIRCUITRY — TWO WIRE NO POLARITY HOOK-UP
- OPTIONAL CONNECTION TO BLANK DISPLAY (Use When Key Off in Car, Etc.)
- TOP QUALITY PC BOARDS & COMPONENTS - EXCELLENT INSTRUCTIONS
- MOUNTING BRACKET INCLUDED

KIT #2001 COMPLETE KIT (Less 9V. Battery) $29.95 EA. 3 OR MORE $27.95 EA.
115 VAC Power Pack #AC-1 $2.00 EA.

ASSEMBLED UNITS ORDER #2001 WT (LESS 9V. BATTERY) WIRED FOR 12 HR. OP. IF NOT SPECIFIED OTHERWISE $39.95 EA. 3 OR MORE $37.95 EA.

60 HZ. XTAL TIME BASE

Will enable Digital Clock Kits or Clock-Calendar Kits to operate from 12V DC. 1"x2"PC Board Power Req: 5-15V (2.5 MA. TYP.) Easy 3 wire hookup Accuracy: ± 2PPM

#TB-1 (Adjustable)

Complete Kit $4.95 ea

Wir & Cal $9.95

PLEXIGLAS CABINETS

Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.

CABINET I
3"H,6¼"W,5½"D
Black, White or Clear Cover
$6.50 ea.

CABINET II
2½"H,5"W,4"D

RED OR GREY PLEXIGLAS FOR DIGITAL BEZELS
3"x6"x1/8" 95¢ ea. 4/$3

SEE THE WORKS Clock Kit Clear Plexiglas Stand

- 6 Big .4" digits
- 12 or 24 hr. time
- 3 set switches
- Plug transformer
- All parts included

Plexiglas is Pre-cut & drilled

Kit #850-4 CP

Size: 6"H,4½"W,3"D

$23.95 ea. 2/$45. A SUPER CLOCK!

JUMBO DIGIT CLOCK

A complete Kit (less Cabinet) featuring: six .5" digits, MM5314 IC 12/24 Hr. time, 50/60 HZ., Plug-Transformer, Line Cord, Switches, and all Parts. (Ideal Fit in Cabinet II) Kit # 5314-5 .... $19.95 2/$38.

WITH PC Board s

JUMBO DIGIT CONVERSION KIT $9.95 ea.

Convert small digit LED clock to large .5" displays. Kit includes 6 - LED's, Multiplex PC Board & easy hook-up info.
Kit # JD-1CC For common Cathode
Kit # JD-1CA for common Anode

TELEPHONE FORMAT KEYBOARD
BY Chomerics
EF-21360
2-1/4"x3"
5/32" thick
$4.95
6/$28.

25 AMP BRIDGE
$1.95 ea.
3/$5.00

NEW LSI TECHNOLOGY

FREQUENCY COUNTER KIT
8 LARGE .4" RED LED DIGITS

- ONLY 8 IC's! • XTAL TIME BASE

A truly "State of the Art" counter using quality components throughout.

KIT INCLUDES: DETAILED INSTRUCTIONS, XTAL, TOP QUALITY FIBERGLASS DOUBLE SIDED PC BOARD, IC'S WITH SOCKETS AND ALL PARTS LESS POWER SUPPLY AND CABINET.

50 MHZ COUNTER KIT	#FC-50	$89.95
5 VOLT REGULATED 1 AMP POWER SUPPLY KIT	#PS-02	$9.95
350 MHZ PRESCALER KIT	#PSL-350	23.95
650 MHZ PRESCALER KIT	#PSL-650	$29.95
CABINET (& MTG HARDWARE) [CABINET WILL HOUSE #FC-50, #PS-02, AND A PRESCALER]	#CAB III	$19.95

DELIVERIES TO START IN MAY, 1977

Fairchild Super Digit FND-359

.4" Char. Ht. 7 segment, LED RED Com. Cath. Direct pin replacement for popular FND-70.

95¢ ea, 10/$8.50 100/$70.00

SET OF 6 FND-359 WITH MULTIPLEX PC BOARD $6.95

NYLON WIRE TIES

8" TIE-WRAP 100/$1.95
4" TIE-WRAP 100/$1.75

PLUG TRANSFORMERS

12 VAC at 150 MA	$ 2.50
12 VAC at 500 MA	3.50
7VAC at 1.75 VA	$3.50

SCHOTTKY TTL

74S00	$ .35
74S01	.40
74S04	.55
74S05	.60
74S08	.55
74S10	.40
74S20	.50
74S22	.45
74S40	.45
74S50	.45
74S51	.55
74S60	.85
74S64	.55
74S74	.85
74S75	1.75
74S78	1.50
74S86	.95
74S107	.95
74S112	.95
74S113	1.40
74S114	.95
74S133	.75
74S134	.75
74S138	1.75
74S139	1.50
74S151	1.95
74S153	1.95
74S156	1.95
74S157	1.90
74S158	2.50
74S174	2.50
74S175	2.50
74S181	2.95
74S182	1.95
74S251	2.75

DIGITAL CLOCK IC's

MM 5312	$ 4.95
MM 5314	3.95
MM 5375 AB	3.95
CT-7001	7.95
CT-7002	13.95
MM 5369	2.50

LED DRIVERS

7447	$ .95
7448	.95
75491	.65
75492	.65

PRESCALE

11C90DC	$15.95
95H90	9.95

VOLTAGE REGULATORS

LM 309 H	TO-5	$ .95
LM 309 K	TO-3	1.25
7805	TAB	.95
7812	TAB	.95
7812	TO-3	1.50
7815	TO-3	1.25
7815	TAB	1.25
78L 15	TO-5	.75
7824	TO-3	1.25
723	DIP	.75
723	TO-5	.75

PROM

1702	E Prom $8.95
5203	E Prom $8.95

SWITCHES

ROCKER SPDT	5/$1
MINI-SLIDE SPDT	5/$1
REG. SLIDE DPDT	5/$1
PUSH BUTTON N.O.	3/$1
MINI SPDT	1.30
TOGGLE DPDT	1.50

IC SOCKETS

PINS	1-24	25	100
8	$ .25	$ .22	$ .20
14	.25	.22	.20
16	.28	.25	.23
18	.31	.28	.26
24	.50	.45	.40
28	.60	.55	.50
40	.75	.70	.65

XTAL

3.579545 MHZ. $1.95

21L02

PRIME - 450 NS
LOW POWER
FAIRCHILD OR SIGNETICS

1-24	$1.95
25-99	1.75
100-199	1.50
200-499	1.40
Over 500	1.40

TRANSISTORS

2N2222 A	TO-18	3/$1.00
2N2712	TO-98	5/$1.00
2N3415	TO-92	5/$1.00
2N3704	TO-92	5/$1.00
2N4400	TO-92	5/$1.00
2N4125	TO-92	5/$1.00
2N4249	TO-92	5/$1.00
2N4437	TO-92	5/$1.00
2N6027	PUT	2/$1.00
2N5457	N J-Fet	2/$1.00

DIODES

IN 4002	1A, 100 PIV	12/$1.00
IN 4005	1A, 600 PIV	11/$1.00
IN 4007	1A, 1000 PIV	10/$1.00
RECTIFIER	2.5A, 1000 PIV	4/$1.00
IN 914	SIL. SIGNAL	20/$1.00
IN 4148	SIL. SIGNAL	20/$1.00
DYAC	28V.	4/$1.00

LINEAR

555	TIMER	2/$1.00
556	DUAL TIMER	.95
565	PLL	.95
566	FUNCTION GEN.	1.75
567	TONE DECODER	1.75

TRANSISTOR SOCKET TO-5/18 GOLD PINS

5/$1.00

7-SEG LED

COMMON CATHODE

	COLOR	HT	DEC PT	PR EA
FND-359	RED	.4"	RHDP	$ .95
FND-503	RED	.5"	RHDP	$1.35
DL-750	RED	.5"	LHDP	$2.95
XAN-054	GREEN	.5"	NDP	$1.95
XAN-564	RED	.5"	NDP	$1.95

COMMON ANODE

DL-747	RED	.5"	LHDP	$1.95
XAN-72	RED	.3"	LHDP	$1.25
MAN-72	RED	.3"	LHDP	$1.25
XAN-81	YELLOW	.3"	RHDP	$1.75
XAN-351	GREEN	.3"	RHDP	$1.50
XAN-361	RED	.3"	RHDP	$1.50
XAN-362	RED	.3"	LHDP	$1.50
XAN-662	RED	.6"	NDP	$1.95
XAN-692	RED	.6"	NDP	$1.95

OP AMPS

3/$1.00

301	TO-5
709	DIP
709	TO 5
741	DIP
741	M-DIP
741	TO-5
747	TO 5

DISCRETE LED's

JUMBO RED

10 FOR $1.00 100 FOR $9.50

PC TRIM POTS

25K 6/$1.00
4.7K 6/$1.00

SPECTROL 10K 10 TURN 95¢ 4/$3.00

MOLEX PINS

Form Inexpensive Sockets

100 for $1.25

Reel of 1000 $8.50

AUTO BURGLAR ALARM KIT

AN EASY TO ASSEMBLE AND EASY TO INSTALL ALARM PROVIDING MANY FEATURES NOT NORMALLY FOUND. KEYLESS ALARM HAS PROVISION FOR POS. & GROUNDING SWITCHES OR SENSORS. WILL PULSE HORN RELAY AT 1HZ RATE OR DRIVE SIREN. KIT PROVIDES PROGRAMMABLE TIME DELAYS FOR EXIT, ENTRY & ALARM PERIOD. UNIT MOUNTS UNDER DASH - REMOTE SWITCH CAN BE MOUNTED WHERE DESIRED. CMOS RELIABILITY RESISTS FALSE ALARMS & PROVIDES FOR ULTRA DEPENDABLE ALARM. DO NOT BE FOOLED BY LOW PRICES! THIS IS A TOP QUALITY COMPLETE KIT WITH ALL PARTS INCLUDING DETAILED DRAWINGS AND INSTRUCTIONS OR AVAILABLE WIRED AND TESTED.

KIT #ALR-1 $9.95

#ALR-1WT WIRED & TESTED $19.95

VARIABLE REGULATED 1 AMP POWER SUPPLY KIT

- VARIABLE FROM 4 to 14V
- SHORT CIRCUIT PROOF
- 723 IC REGULATOR
- 2N3055 PASS TRANSISTOR
- CURRENT LIMITING AT 1 Amp

KIT IS COMPLETE INCLUDING DRILLED & SOLDER PLATED FIBERGLASS PC BOARD AND ALL PARTS (Less TRANSFORMER) KIT #PS-01 $9.95

TRANSFORMER 24V CT will provide 300MA at 12V and 1 Amp at 9V with #PS-01. $3.50

OPTOELECTRONICS, INC.
BOX 219 • HOLLYWOOD, FLA. 33022 • (305) 921-2056
STORE: 823 S. 21 AVE.

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ORDER BY PHONE OR MAIL
COD ORDERS WELCOME
Orders Under $15 Add $1.00 Handling
Fla. Res. Please Add 4% Sales Tax.

WE PAY ALL SHIPPING IN CONTINENTAL USA — OTHERS ADD 5% (10% FOR AIRMAIL)
SEE OUR BOOTHS AT THE ATLANTA HAMFESTIVAL - JUNE 18-19, 1977

New! Synthacoder

☆ ALL NEW SYNTHESIZER/ENCODER FROM ENGINEERING SPECIALITIES
THE ULTIMATE IN FREQUENCY CONTROL FOR IC-22S OWNERS!

No more soldering diodes every time you want to try a new repeater!
Just plug the Synthacoder into the back of your radio, select channel 22, and the Synthacoder takes command of your radio – Giving you fingertip control of ALL frequencies.

- Front Panel Thumbwheel Control of All Channels!
- Fully Automatic Invalid Code Control!
- Small Size: 3¾" x 1½" x 6"
- Factory Wired and Tested
- Easy To Install

SPECIAL
only $87.95
postpaid
CA Residents add 6% sales tax

Engineering Specialties

P.O. BOX 2233
1247 COMMERCIAL AVENUE
OXNARD CA 93030
(805) 486-0817

☐ I'LL BITE! Please send more info.
☐ I'M HOOKED! Please RUSH my Synthacoder.

YES, I would like to purchase a Synthacoder for my IC-22S. Enclosed please find my $87.95 (Price includes postage and handling). California residents add 6% sales tax.

$_____ enclosed. ☐ Cash ☐ Check ☐ Money Order
Please charge my ☐ Master Charge ☐ BankAmericard
Credit card #_____
Interbank #_____
Expiration date_____
Signature_____

Name_____ Call_____
Address_____
City_____ State_____ Zip_____

E12

The SUPER COMPACT
$13.95 Complete

.4" LED
12 or 24 Hr.

Includes: All Parts, PC Board
Power Supply & Case

Colors: Black, Silver, or Gold
Size: 4.75" x 1.8" x 1.4"
Material: Extruded Alum.

OPTION — Temperature Ind. Front Panel — $3.00

BIG-BRIGHT - .5" LED ALARM CLOCK
6 DIGIT AC or DC or ELAPSED TIMER KIT
$19.95 Complete

- PC Board Drilled & Silk Screened (Includes Xtal Time Base Circuitry)
- 5375 Nat. Clock Chip & Fairchild Displays
- Includes EVERY part required for clock and all options except Cabinet and Crystal Time Base components. If desired, see below.
- Brightness Control
- 24 Hr. Alarm w/snooze
- Freeze feat. on every mode
- 0-60 Min. Elapsed Timer
- Field Tested over 1 Yr.
- 12 Hr., 60 Hz oper.

Most Important — Complete Instructions, schematics Pictorials, layouts — everything for trouble free assembly
OPTION — XTAL Time Base Components - $2.95 when purchased w/clock

Clock Kit Accessories

Wooden Case - Walnut gr. incl. Filter ..... **$4.00 each**
Dimension - 6 5/16" W x 2 9/16" H x 3 7/16" D (¼" Material)

Plexiglass Case (Ch. - Bl., White, Blue, & Smoke) incl. Filter ..... **$3.00 each**
Dimensions - 5 13/16" W x 2 1/4" H x 5 3/8" D (⅛ Material)

Individual Filters - Red, Smoke, Blue, Amber and Green ..... **$.60 each**

60 Hz. Crystal Time Base
For: Cars, Boats **Campers, Field Use**
$4.95 COMPLETE

KIT INCLUDES: P.C. Board Drilled & Silk Screened
Crystal, MOS 17 Stage Divider IC, all necessary components, Inst. Sheets & Specs.

FEATURES:
- 60 Hz output
- Low Power Drain
- Accuracy
- Small Size
- Direct interface with all MOS Clock Chips

AC/DC - ALARM Clock Kit - 12/24 Hr.
$7.50 quantities of 1-5 $6.50 quantities of 6 & up

- **Your choice of Display Colors - Red, Green, Blue, Amber**
- Displays Hrs. & Min. - Switch to Min. & Secs. on Command
- AM/PM Indication
- Field Tested for 6 months

The kit will include a 5316 National Clock Chip, 4 Flourescent Display tubes, all electronic components, switches, controls & complete instructions, specs, etc. for clock and all optional Features. Other parts required or if desired are as follows:

- PC Board, Drilled & Silk Screened for Clock & all options $3.00
- Xformer (for AC oper.) — $1.00
- App. (SCR output) timer kit — $2.00
- Speaker Alarm Kit — $2.00
- Count Down (turn-off) timer kit — $2.00

The LS LINE of TTL
Low Power, High Speed Schottky, Factory Prime

74LS00 — .29	74LS27 — .33	74LS155 — 1.10
74LS02 — .29	74LS30 — .33	74LS157 — 1.10
74LS04 — .32	74LS32 — .35	74LS160 — 1.50
74LS08 — .29	74LS37 — .35	74LS162 — 1.50
74LS10 — .29	74LS38 — .35	74LS163 — 1.50
74LS11 — .33	74LS74 — .50	74LS175 — 1.50
74LS20 — .33	74LS90 — .90	74LS258 — 1.25
74LS21 — .33	74LS132 — .90	74LS367 — .90
74LS22 — .33	74LS138 — .90	74LS368 — .90
	74LS139 — .90	

6 DIGIT LED MOBILE
Clock Kit & Elapsed Timer

.4" Digits 12 or 24 Hr.
Quartz Crystal Controlled
12 Volt DC or AC operation

$27.95 Complete (less 9V battery)

- Protection from noise & High Impulses
- Display Blanking Capability
- Battery Back-Up Capability
- Size: 4" x 1⅜ x 4½"
- Rugged High Impact ABS
- Recessed Front Switches

OPTION — AC Adaptor $2.50

Big Digits

THE BIG ONE
.8" LED Alarm Clock Kit

Big Bargain Price

$17.95 ea.

Includes:
PC Board, Clock Chip, Switches
Fairchild .8" Display Module,
xistors, resistors, capacitors,
Complete Instructions

Features:
- Hrs. & Min. Switch to Min. & Sec. on Command
- 12 Hr. - 24 Hr. Alarm
- 10 Min. Snooze
- AM/PM Indicators
- Sleep Output

National MA1001A Digital Alarm Clock Module
including Power Supply
$9.95 complete

- 4 Digit 0.5" Display
- 12 Hr. 50/60 Hz. oper.
- Brightness Cont. Cop.
- Alarm & Snooze Timers

Blinky/Flasher/Timing Kit
$2.50 each 5 for $10.00

Kit includes:
P.C. Board, 555 Timer, all components and a connector for a 9V Battery

SPECIALS

8080A Microprocessor	$19.95 ea.
21L02-1 Low Power 500NS RAM	$1.95 ea.
.6" Display Common Anode or Cathode	$1.95 ea.
.5" Fairchild Display Com. Anode or Cathode (Same as FTK 0001 & FTK 0002)	79¢ ea.
.8" 3½ Digit Display Module (Same as FTK 0010)	$5.40
LM340T Series Regs. - 5, 6, 12, 15 & 24 V (pos.)	99¢
LM309K - 5 Volt Regulator	79¢
LM741 Op. Amp. 14 Pin Dip Pkg.	4 for 99¢
2N3055 NPN Transistor TO-3 Pkg.	59¢
2N4904 PNP (complement to 2N3055)	69¢
25 Amp - 200 Volt Full Wave Bridge	$1.49
10 Pk - 220 Power Tab Xistors, NPN & PNP Asst.	$1.49
15 Pk - LED's Assorted Sizes and Colors	$1.49
Bi-Polar LED - Red/Green	$1.00

6 Digit LED Stop-Watch Kit
Split Time **$29.95 complete** Taylor Time

FEATURES:
- Simple construction needing only the parts listed below
- Small enough for hand held case
- Needs only 3-AA cell batteries

KIT INCLUDES:
- Latest Technology Intersil Mos Chip # 7205
- 3.2768 MHz Crystal
- Variable Trimmer Cap
- 2 mini slide & 3 MOM. PB Switches
- 3 pairs (6 digits) Double Digit LED Displays

P.C. BOARD for above

Hand held case designed for above $3.95

HOBB-Y-TRONIX, INC.
Box 511, Edison, N.J. 08817

Orders must incl. Ck. - No COD's - Add $1.00 handling for orders under $25.00
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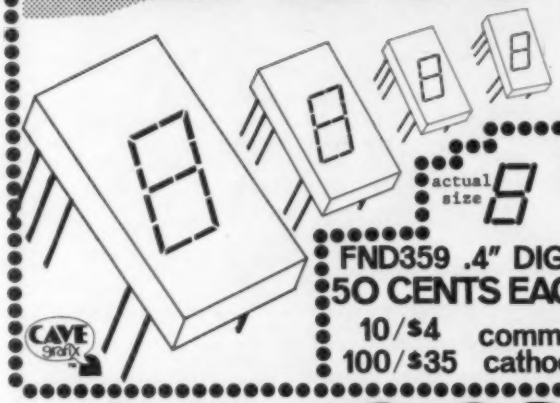

actual size

FND359 .4" DIGIT
50 CENTS EACH
10/$4
100/$35
common cathode

2 :12:28 **.8" (!) digit Clock Display**

$4.95 EACH; 3/$12.50 DON'T CONFUSE THIS WITH THE .5" TYPES OFFERED BY OTHERS. THESE DIGITS ARE BIG! AM/PM INDICATOR, COLON, AND 3½ DIGITS WRAPPED IN A CLEAR RED PLASTIC ENCLOSURE. COMMON CATHODE. LIMITED QTY.

3 **BRIGHT .5" DIGIT**
FND503 COM CATHODE
FND510 COM ANODE
actual size
10/$8.50 or 95¢ each

POWER transistor 75¢
house number, similar to 2N3055

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BOX 2355, OAKLAND AIRPORT, CA 94614

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Standard UART $5.50
part # TR-1602B PRIME!

teflon hookup wire

HI FLEXIBILITY, TOP QUALITY STRANDED WIRE WITH INSULATION THAT DOESN'T MELT UNDER NORMAL HEAT. SORRY, NO CHOICE OF COLOR.....250 ft /$2.95

VECTOR'S "SLIT-N-WRAP"

$24.50
+2 lbs postage

This tool is a manual wrapping device, which supplies insulated wire directly to wrapping posts without pre-stripping or pre-cutting. More than one level of wrap is rarely required. Speed your breadboarding time tremendously with this tool, and don't bother stocking all that pre-stripped and pre-cut wire you would normally require.

12V 8A supply CB, HAM...$39.95

kit form only

+ POSTAGE. Now you can connect CB and ham transceivers...auto tape players...portable TVs...to your AC house current; also makes a superb lab or bench supply. Crowbar overvoltage protected, short protection, 0.05V regulation, adjustable output 11-14V, and EASY ASSEMBLY---heat sinks, power transistors etc. mount on board. A SUPER SUPPLY!!

Did you see our ad in this month's issue of Kilobaud? We're featuring something computer bugs can't resist---an 8K X 8 memory kit, ECONORAM II™, that boasts all the features of its little brother and then some. Best of all is the price: $163.84---~~¢~~/bit!

To go along with that, check out our new Motherboard kit ($80). Comes with edge connectors for 10 S-100 buss peripherals, and active, on board regulated terminations that minimize crosstalk, overshoot, and other buss gremlins.

MINIATURE TRIMMER CAPS

5/$2, any one value. Choose from (in pF): 2-8, 2.5-11, 5.8-18, 7-25, and 9-35.

74LS TTL

74LS00	$0.36	74LS139	1.38
74LS01	0.36	74LS155	1.38
74LS02	0.36	74LS157	1.25
74LS04	0.42	74LS160	1.85
74LS08	0.38	74LS161	1.85
74LS10	0.36	74LS162	1.85
74LS11	0.38	74LS163	1.85
74LS14	1.38	74LS168	1.87
74LS20	0.36	74LS169	1.87
74LS21	0.38	74LS174	1.38
74LS22	0.38	74LS175	1.35
74LS27	0.38	74LS221	1.38
74LS30	0.36	74LS240	1.88
74LS32	0.38	74LS257	1.25
74LS37	0.53	74LS258	1.30
74LS38	0.53	74LS273	2.25
74LS42	1.25	74LS283	1.20
74LS74	0.56	74LS367	1.00
74LS75	0.85	74LS368	1.00
74LS109	0.60	74LS377	1.88
74LS124	2.50	74LS378	1.38
74LS125	0.75	81LS95	1.13
74LS126	0.75	81LS96	1.13
74LS132	1.50	81LS97	1.13
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JUST IN! 20 µF @ 16V axial electrolytic capacitor 10/$1

G4

Clever buyers request our free flyer

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SN7403N	.16	SN7473N	.39	SN74157N	.59
SN7404N	.18	SN7473N	.37	SN74158N	.59
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SN7412N	.50	SN7486N	.89	SN74170N	2.10
SN7413N	.45	SN7488N	.39	SN74172N	6.95
SN7414N	.70	SN7489N	3.50	SN74173N	1.50
SN7416N	.35	SN7490N	2.49	SN74174N	1.25
SN7417N	.39	SN7491N	.49	SN74175N	.69
SN7420N	.21	SN7491N	.75	SN74176N	.99
SN7421N	.33	SN7492N	.49	SN74177N	.99
SN7422N	.49	SN7493N	.49	SN74180N	.99
SN7423N	.37	SN7494N	.79	SN74181N	2.49
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SN7437N	.27	SN74122N	.39	SN74190N	1.19
SN7438N	.27	SN74123N	.59	SN74191N	1.25
SN7439N	.25	SN74125N	.60	SN74192N	.69
SN7440N	.15	SN74126N	.60	SN74193N	.69
SN7441N	.89	SN74132N	1.89	SN74194N	1.25
SN7442N	.99	SN74136N	.79	SN74195N	.75
SN7443N	.75	SN74141N	1.15	SN74196N	1.25
SN7444N	.75	SN74142N	4.50	SN74197N	.75
SN7445N	.75	SN74143N	4.50	SN74198N	1.75
SN7446N	.81	SN74144N	4.50	SN74199N	1.75
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SN7448N	.79	SN74147N	2.35	SN74279N	.90
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20% Discount for 100 Combined 7400's

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CD4006	2.50	CD4049	.45	74C30N	.65
CD4007	.25	CD4042	1.50	74C42N	2.15
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CD4010	.59	CD4047	2.51	74C74	1.15
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CD4012	.35	CD4049	.79	74C89N	2.00
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CD4020	1.49	CD4085	1.75	74C160	3.25
CD4022	1.25	CD4069	.45	74C161	3.25
CD4023	.25	CD4071	.45	74C163	3.00
CD4024	1.50	CD4081	.45	74C164	3.25
CD4025	.25	CD4511	2.50	74C173	2.00
CD4027	.69	CD4518	2.50	74C193	2.75
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LM307CN	.35	LM320T-12	1.00	LM2901N	2.95
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LM308CN	1.00	LM324N	1.75	LM3905N	.55
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LINEAR

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LM311N	.90	LM340T-15	1.00	LM3914N	3.00
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LM319N	1.30	LM340K-5	1.00	LM3917N	3.00
LM320K-5	1.35	LM340K-6	1.00	LM3918N	3.00
LM320K-5.2	1.35	LM340K-8	1.00	LM3919N	3.00
LM320K-12	1.35	LM340K-12	1.00	LM3920N	3.00
LM320K-15	1.35	LM340K-15	1.00	LM3921N	3.00
LM320K-18	1.35	LM340K-18	1.00	LM3922N	3.00
LM320K-24	1.35	LM340K-24	1.00	LM3924N	3.00
LM320T-5	1.75	LM340T-6	1.00	LM3955N	3.00
LM320T-5.2	1.75	LM340T-8	1.00	LM3966N	3.00
LM320T-6	1.75	LM340T-12	1.00	LM3967N	3.00
LM320T-12	1.75	LM340T-15	1.00	LM3968N	3.00
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LM340K-24	1.95	LM340T-12	1.00	LM3981N	3.00
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LM340T-6	1.75	LM340T-18	1.00	LM3983N	3.00
LM340T-8	1.75	LM340T-24	1.00	LM3984N	3.00
LM340T-12	1.75	LM340K-5	1.00	LM3985N	3.00
LM340T-15	1.75	LM340K-6	1.00	LM3986N	3.00
LM340T-18	1.75	LM340K-8	1.00	LM3987N	3.00
LM340T-24	1.75	LM340K-12	1.00	LM3988N	3.00
LM350K	1.95	LM340K-15	1.00	LM3989N	3.00
LM351CN	.65	LM340K-18	1.00	LM3990N	3.00
		LM340K-24	1.00	LM3991N	3.00

74LS00 TTL

74LS00	29	74LS74	.49	74LS153	1.69
74LS02	29	74LS75	.69	74LS157	1.55
74LS03	29	74LS76	.49	74LS162	2.25
74LS04	35	74LS83	1.75	74LS163	2.25
74LS05	35	74LS85	2.49	74LS164	1.95
74LS08	29	74LS86	.49	74LS175	1.75
74LS10	29	74LS90	1.35	74LS181	3.69
74LS11	69	74LS92	1.35	74LS190	2.85
74LS14	1.75	74LS93	1.25	74LS191	2.85
74LS20	29	74LS95	1.95	74LS192	2.85
74LS21	39	74LS96	1.89	74LS193	2.85
74LS30	29	74LS107	.59	74LS194	1.69
74LS32	39	74LS109	.59	74LS195	1.69
74LS40	39	74LS112	.59	74LS257	1.75
74LS51	29	74LS132	1.25	74LS260	.55
74LS55	29	74LS136	.59	74LS279	.79
74LS73	.49	74LS138	1.69	74LS670	3.95

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MM5309	6 Digit, BCD Outputs, Reset PIN	99.9s
MM5311	6 Digit, BCD Outputs, 12 or 24 Hour	4.95
MM5312	4 Digit, BCD Outputs, 1 PPS Output	4.95
MM5314	6 Digit, 12 or 24 Hour, 50 or 60 Hz	4.95
MM5316	4 Digit, Alarm, 1 PPS Output	6.95
MM5318	Video Clock Chip, For Use With (MM5841 - $9.95)	9.95
CT7001	6 Digit, Calendar, Alarm, 12 or 24 Hour	5.95

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7400	Pin-out & Description of 5400/7400 ICS	$2.95
CMOS	Pin-out & Description of 4000 Series ICS	$2.95
Linear	Pin-out & Functional Description	$2.95
	ALL THREE HANDBOOKS $6.95	

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They can try and copy our ad, BUT They can't copy our service!

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.125" dia.

XC280	Red	10/$1	XC111	Red	10/$1
XC280	Green	4/$1	XC111	Green	4/$1
XC280	Orange	4/$1	XC111	Yellow	4/$1
XC280	Yellow	4/$1	XC111	Orange	4/$1

.190" dia.

.195" dia.

XC20	Red	10/$1	XC526	Red	10/$1
XC22	Green	4/$1	XC526	Green	4/$1
XC22	Yellow	4/$1	XC526	Yellow	4/$1
XC22	Orange	4/$1	XC526	Orange	4/$1
SSL-22	RT	4/$1	XC526	Clear	4/$1

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XC556	Red	10/$1	MV50 - Red - 6/$1
XC556	Green	4/$1	
XC556	Yellow	4/$1	
XC556	Orange	4/$1	
XC556	Clear	7/$1	

.300" dia.

INFRA-RED LED ¼" x ¼" x 1.10" Flat $/$1.00

SPECIAL * — XC556 Red 100/$8.00 1000/$60.00 — SPECIAL *

DISPLAY LEDS

DL707

TYPE	POLARITY	HT	
MAN 1	Common Anode	.270	2.95
MAN 2	5 x 7 Dot Matrix	.300	4.95
MAN 3	Common Cathode	.125	3/1.00
MAN 4	Common Cathode	.197	1.95
MAN 7	Common Anode	.300	1.25
MAN 7G	Common Anode-green	.300	1.95
MAN 7Y	Common Anode-yellow	.300	1.95
MAN 52	Common Anode-green	.300	.99
MAN 64	Common Anode-red	.400	.99
MAN 74	Common Cathode	.300	1.50
MAN 82	Common Anode-yellow	.300	.99
MAN 84	Common Cathode-yellow	.300	.99
MAN 3620	Common Anode -orange	.360	1.75

DL339

TYPE	POLARITY	HT	
MAN 3640	Common Cathode-orange	.300	1.75
MAN 4710	Common Anode-Red	.400	1.95
DL701	Common Anode-red ±	.300	.99
DL704	Common Cathode	.300	.99
DL707	Common Anode	.300	.99
MAN 4740	Common Anode-Red	.400	.99
DL741	Common Anode	.600	1.39
DL 747	Common Anode	.600	2.25
DL 750	Common Cathode	.600	2.49
DL 339	Common Cathode	.110	.59
FND70	Common Cathode	.250	.75
FND503	Common Cathode	.500	1.69
FND507	Common Anode	.500	1.99

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ATARI GAME BOARDS

BOARD A — 8½" x 10"
Over 60 each reusable IC's — **$5.95 ea.**
Misc. Transistors, Resistors, Diodes, Caps, Crystals, Switch, etc. — ONLY 500 EA. AVAILABLE

DELUXE BOARD B — 11½" x 16" — **$9.95 ea.**
Over 100 each reusable IC's — ONLY 500 EA.
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NEW AY-3-8500-1 TV GAME CHIP

- Score display
- Selectable angles, speed and bat size
- Auto or manual ball service
- Realism sounds
- 6 Games — tennis, hockey, soccer, squash, pelota/practice and two rifle games

28 Lead Dual In Line

The circuit is intended to be battery powered. Minimum number of external components required for complete system.

$24.95

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin	$.17	.16	.15
14 pin	.20	.19	.18
16 pin	.22	.21	.20
18 pin	.29	.28	.27
22 pin	.37	.36	.35
24 pin	$.27	.25	.24
28 pin	.34	.32	.30
40 pin	.49	.46	.43

	1-24	25-49	50-100
24 pin	$.38	.37	.36
28 pin	.45	.44	.43
40 pin	.59	.58	.56
40 pin	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

28 pin	$. 59	.59	.61
36 pin	1.39	1.35	1.15
40 pin	1.59	1.45	1.30

SOLDERTAIL STANDARD (GOLD)

6 pin	$.30	.27	.24
14 pin	.35	.32	.29
16 pin	.39	.35	.32
18 pin	.52	.47	.43
24 pin	$. 70	.63	.57
28 pin	1.10	1.00	.90
36 pin	1.75	1.40	1.26
40 pin	1.75	1.58	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37
14 pin	.39	.38	.37
16 pin	.43	.42	.41
18 pin	.75	.66	.62
24 pin	$1.05	.85	.65
28 pin	1.49	1.35	1.18
36 pin	1.58	1.45	1.30
40 pin	1.75	1.55	1.40

Plastic Push Button Switch

- **16 AWG Solid Wire - 6" Long**
- **.50 (wide) X .80 (high) ¼-27 Thread**
- **5 AMP @ 14 Volt - 1 AMP @ ±18 Volt**

		1-9	10-Up
J-180-1	Push On-Push Off	.59	.49
J-180-2	Normally Open	.59	.49
J-180-3	Normally Closed	.59	.49

MINATURE TOGGLE SWITCH

JMT-221	DPDT	on/off/on	$1.95
JMT-223	DPDT	on/none/on	$1.75
JMT-121	SPDT	on/off/on	$1.50
JMT-123	SPDT	on/none/on	$1.25

CLIPLITE 8/$1.49

LED MOUNTING SYSTEM use with XC556 LEDS

Specify Colors — Red - Green - Amber - Yellow

DIP SWITCHES

DPST Slide Action

#206-4 (8 pin dip) 4 switch unit **$1.75 ea.**
#206-7 (14 pin dip) 7 switch unit **$1.98 ea.**
#206-8 (16 pin dip) 8 switch unit **$2.25 ea.**

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM	12 OHM	15 OHM	18 OHM	22 OHM		
		27 OHM	33 OHM	39 OHM	47 OHM	56 OHM	1/4 WATT 5% - 50 PCS.	
ASST. 2	5 ea.	68 OHM	82 OHM	100 OHM	120 OHM	150 OHM		
		180 OHM	220 OHM	270 OHM	330 OHM	390 OHM	1/4 WATT 5% - 50 PCS.	
ASST. 3	5 ea.	470 OHM	560 OHM	680 OHM	820 OHM	1K		
		1.2K	1.5K	1.8K	2.2K	2.7K	1/4 WATT 5% - 50 PCS.	
ASST. 4	5 ea.	3.3K	3.9K	4.7K	5.6K	6.8K		
		8.2K	10K	12K	15K	18K	1/4 WATT 5% - 50 PCS.	
ASST. 5	5 ea.	22K	27K	33K	39K	47K		
		56K	68K	82K	100K	120K	1/4 WATT 5% - 50 PCS.	
ASST. 6	5 ea.	150K	180K	220K	270K	330K		
		390K	470K	560K	680K	820K	1/4 WATT 5% - 50 PCS.	
ASST. 7	5 ea.	1M	1.2M	1.5M	1.8M	2.2M		
		2.7M	3.3M	3.9M	4.7M	5.6M	1/4 WATT 5% - 50 PCS.	
ASST. 8R	Includes Resistor Assortments 1-7 (350 PCS.)						**$10.95 ea.**	

$5.00 Minimum Order — U.S. Funds Only
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HOBBY-WRAP TOOL-BW-630

- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (.025 inch)
- Complete with built-in bit and sleeve

$34.95 (batteries not included)

WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP

- Tool for 30 AWG Wire
- Roll of 50 Ft. White or Blue 30 AWG Wire
- 50 pcs. each 1", 2", 3" & 4" lengths — pre-stripped wire.

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WIRE WRAP TOOL WSU-30

WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

25 ft. min. $1.25 50 ft. $1.95 100 ft. $2.95 1000 ft. $15.00
SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

CUTTER CRIMPER TOOL (CS-8)

- Plier Nose (serrated-jaw)
- Scissors Action Cutting
- 6 Bolt Cutters (4-40, 5-40, 6-32, 8-32, 10-32, 10-24)
- Crimp Stations (7mm Axle — 22-20 to 12-X0 elect.)
- "Up-Front" Wire Cutting
- Scissors Action Stripping (No. 22-20 to No. 10)
- Crimp Stations — insulated (2w-20 to 12-10 elect.)

Actual Size - 8¼" length **$8.50**

Permacel Electrical Tape

- ¾" (wide) X 66 ft. (long) • All weather • Not import

$1.25 per roll — $9.95 per 10 roll package

ZENERS — DIODES — RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400mw	4/1.00	1N4005	600 PIV 1 AMP		10/1.00
1N751A	5.1	400m	4/1.00	1N4005	800 PIV 1 AMP		10/1.00
1N752	5.6	400m	4/1.00	1N4007	1000 PIV 1 AMP		10/1.00
1N753	6.2	400m	4/1.00	1N3880	50	250m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N889	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N4983	15	400m	4/1.00	1N4305	75	25m	30/1.00
1N5232	5.6	500m	2/$	1N4734A	5.6	1w	2/$
1N5234	6.2	500m	2/$	1N4735	6.2	1w	2/$
1N5235	6.8	500m	2/$	1N4736	6.8	1w	2/$
1N5236	7.5	500m	2/$	1N4738	8.2	1w	2/$
1N4454	25	40n	6/1.00	1N4742	12	1w	2/$
1N458	150	7m	6/1.00	1N4744	15	1w	2/$
1N4485A	100	10m	6/1.00	1N1183	50 PIV	35 AMP	1.00
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.80
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.90
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C35D	15A @ 400V	SCR	$1.95
C35M	35A @ 200V	SCR	1.95
2N2328	1.6A @ 200V	SCR	.99
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

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MPS A06	5/$1.00	PN2907A	3/$1.00	PN2222A	4/$1.00
2N2219A	3/$1.00	PN2369	4/$1.00	2N4402	4/$1.00
2N2221	4/$1.00	PN2369A	4/$1.00	2N4403	4/$1.00
2N2222A	4/$1.00	2N2484	5/$1.00	2N4410	4/$1.00
2N2369	5/$1.00	2N2905	5/$1.00	2N4400	5/$1.00
2N2369A	4/$1.00	2N2906	5/$1.00	2N4401	4/$1.00
2N2484	4/$1.00	2N2907	5/$1.00	2N5086	4/$1.00
2N2904A	4/$1.00	2N2711	5/$1.00	2N5087	4/$1.00
2N2905	5/$1.00	2N3704	5/$1.00	2N5089	4/$1.00
2N2905	5/$1.00	2N3705	$. 65	2N5089	4/$1.00
2N3053	3/$1.00	2N3706	.65	2N5210	4/$1.00
2N3055	1.00	2N3707	.65	2N5219	4/$1.00
MJE3055	$1.00	2N3903	5/$1.00	2N5220	5/$1.00
MJE2955	$1.25	2N3904	5/$1.00	2N5551	5/$1.00
2N3390	5/$1.00	2N3905	4/$1.00	2N5551	5/$1.00
2N3391	5/$1.00	2N3906	4/$1.00	C106B1/SCR	1.00
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		2N4014	3/$1.00		
		2N4123	10/$1.00		

CAPACITOR 50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100
10 pf	.05	.04	.03
22 pf	.05	.04	.03
47 pf	.05	.04	.03
100 pf	.05	.04	.03
220 pf	.05	.04	.03
470 pf	.05	.04	.035

CORNER

	1-9	10-49	50-100
.001µf	.05	.04	.035
.0047µf	.05	.04	.035
.01µf	.05	.04	.03
.022µf	.06	.05	.04
.047µf	.06	.05	.04
.1µf	.12	.10	.075

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07
.0022	.12	.10	.07
.0047mf	.12	.10	.07
.01mf	.12	.10	.07
.022mf	.13	.11	.08
.047mf	.21	.17	.13
.1mf	.27	.23	.17
.22mf	.33	.27	.21

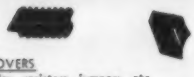
+-20% DIPPED TANTALUM (SOLID) CAPACITORS

1.0/35V	.39	.23	.17
15/35V	.39	.23	.17
.33/35V	.39	.23	.17
.33/35V	.39	.23	.17
47/35V	.39	.23	.17
68/35V	.39	.23	.17
1.0/35V	.39	.23	.17

2.2/35V	.39	.23	.17
3.3/35V	.39	.23	.17
4.7/35V	.39	.23	.17
6.8/25V	.39	.31	.27
10/25V	.40	.35	.35
15/25V	.83	.58	.49

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

Axial Lead			Radial Lead		
47/6WV	.15	.13	.10	47/25V	.15	.13	.10
1.0/6WV	.15	.14	.11	47/6WV	.16	.14	.11
3.3/6WV	.15	.13	.10	1.0/16V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/6WV	.15	.13	.10	1.0/50V	.16	.14	.11
10/25V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.16	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	.15	.13	.10
100/25V	.24	.20	.16	10/50V	.16	.14	.12
100/50V	.35	.30	.26	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.36	100/25V	.24	.20	.18
470/25V	.53	.39	.37	100/50V	.35	.30	.26
1000/16V	.50	.39	.45	220/16V	.23	.17	.16
2200/16V	.75	.62	.55	470/25V	.31	.26	.23



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Use for mounting diodes, resistors, jumpers, etc.
Gold plated parts for long wear.

	PLUGS			COVERS	
	1-24	25-49	50-99	1-24	25-99
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14 pin	.48	.40	.34	.10	.09
16 pin	.56	.47	.38	.10	.09
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PRICE CHARTS

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No Of Pins	Length 6"	12"	18"	24"	36"	48"
14P ·····	1.51	1.62	1.72	1.83	2.05	2.26
16P ·····	1.64	1.76	1.87	1.99	2.21	2.44
24P ·····	2.49	2.69	2.88	3.08	3.48	3.87

DOUBLE END

14P ·····	2.76	2.87	2.97	3.08	3.30	3.51
16P ·····	3.01	3.13	3.24	3.36	3.58	3.81
24P ·····	4.55	4.75	4.94	5.14	5.54	5.93

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1"	$1.48 (WW30VC-1)	$11.84 (WW30BK-1)
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100ft Roll in poly bag...$3.45 10 Rolls, mixed....$24.00

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14 pin 38¢ ea, 10 for $3.60 16 pin 42¢ ea, 10 for $3.90

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D2135	400V, 25A	$1.00
D2138	600V, 25A	$1.55
3289	200V, 100A	$5.85

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Anny is shown operating one of these versatile units which consists of a 1/2" magnetic tape recorder sitting on top of keyboard/controller/display module. These units were made by PERTEC, one of the most respected names in data recording and were used to replace punched card input. They are of late design and recent manufacture. From the operators chair, it is just like a key-punch. Instead of data going into cards in Hollerith, it goes onto Mag tape in EBCDIC. They may be used for that purpose or the tape drive can be separated, control and data lines brought out for use directly on your system. Has internal memory/buffer for 80 or 200 character storage. Display panel indicates character, character number, record number. Read back circuits allows search on record key, editing, duplicating...! These are not obsolete!!! A giant factory closing brings you these at about 5¢ on the dollar. All units are complete and in good condition. They have not been functionally tested but have been inspected for damage. All are sold on as is basis. There are national service shops for these units and parts are available. Hundreds of these units are being used right now in business and industry.
Prices are as is (complete and inspected), F.O.B. our warehouse in Rochester, N.Y. and shipped by truck, freight collect only. Unit weight is approximately 70 lbs. Comes in 7 or 9 track versions. Model 4311 has remote data communication channel. All units, less tape.
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Operators and maintenance manuals(sold separately only)$20

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T1

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2N2483	.34
2N2484	.45
2N2905	.35
2N2907	.25
2N2926G	.24
2N2926Y	.24
2N3053	.50
2N3390	.75
2N3439	1.59
2N3440	.60
2N3512	1.15
2N3553	1.40
2N3565	.22
2N3584	.30
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12 OR 24 HOUR CLOCK KIT. Comes with Big 0.5 Seven Segment LEDs. Uses National 5314 Clock Chip. Fits our Walnut Grain or Plexiglas Cabinets. ONLY $18.95

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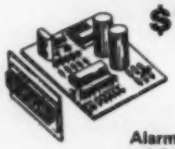
JUMBO LED CAR CLOCK



$16.95

KIT

Alarm Option – $1.50
AC XFMR – $1.50

THE HOTTEST SELLING KIT WE EVER PRODUCED!

You requested it! Our first D.C. operated clock kit. Professionally engineered from scratch. Not a makeshift kluge as sold by others.

Features:

A. Bowmar Jumbo –.5 inch LED array.
B. MOSTEK – 50250 – Super Clock Chip.
C. On board precision crystal time base.
D. 12 or 24 Hr. Real Time Format.
E. Perfect for cars, boats, vans, etc.
F. P.C. Board and all parts (less case) included.

50,000 SATISFIED CLOCK KIT CUSTOMERS CANNOT BE WRONG!

THIS MONTH'S SPECIALS

AMD – 8080A	$14.95
Z-80 CPU	49.95
82S129 1K PROM	2.50

1702A 2K EPROM

We tell it like it is. We could have said these were factory new, but here is the straight scoop. We bought a load of new computer gear that contained a quantity of 1702 A's in sockets. We carefully removed the parts, verified their quality, and are offering them on one heck of a deal. First come, first served. Satisfaction guaranteed! U.V. Eraseable. $6.95 ea. 4/$25

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21L02-1 1K LOW POWER 500 NS STATIC RAM Time is of the essence!

And so is power. Not only are our RAM's faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02—1 low power and super fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off.

8 for $12.95

60 HZ CRYSTAL TIME BASE

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$5.95 ea. 2/$10.00

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS clock chips.
C. Super low power consumption (1.5 MA typ.)
D. Uses latest MOS 17 stage divider IC.
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small size; can be used in existing enclosures.

Kit includes Crystal, Driver IC, PC board, plus all necessary parts and specs. At last count – over 20,000 sold!

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$12.95 MOS 6 DIGIT UP–DOWN COUNTER $12.95

40 PIN DIP. Everything you ever wanted in a counter chip. Features: Direct LED segment drive, single power supply (12 VDC TYPE.), six decades up/down, pre-loadable counter, separate pre-loadable compare register with compare output, BCD and seven segment outputs, internal scan oscillator, CMOS compatible, leading zero blanking. 1MHZ. count input frequency. Very limited quantity! WITH DATA SHEET

7400—19c	7411—29c	7451—19c	7490—65c	74153—75c
74LS00—49c	7413—50c	7453—19c	74LS90—95c	74154-1.00
7402—19c	7416—69c	7473—39c	7492—75c	74157—75c
74LS02—49c	7420—19c	7474—35c	7493—69c	74161—95c
7404—19c	7430—19c	74LS74-59c	7495—75c	74164-1.10
74L04—29c	7432—34c	7475—69c	7496—89c	74165-1.10
7404—44c	7437—39c	7476—35c	74121-38c	74174—95c
74LS04-49c	7438—39c	7480—49c	74123-65c	74181-2.50
7406—29c	7440—19c	7483—95c	74132-1.70	74191-1.25
7408—19c	7447—85c	7485—95c	74S138-1.95	74192-1.25
7410—19c	7448—85c	7486—45c	74141-75c	74193-1.00

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1000 MFD Filter Caps

Rated 35 WVDC Upright style with PC leads. Most popular value for hobbyists. Compare at up to $1.19 ea. from franchise type electronic parts stores. S.D. Special 4/$1.

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P.C. LEAD DIODES

1N4148/1N914 100/$2.00
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HEAVY DUTY

Full Wave Bridge
25 AMP 50 PIV
$1.25

Disc Cap Assortment

PC leads. At least 10 different values. Includes .001, .01, .05, plus other standard values. 60/$1.00

$9.95 KIT

P.C. Board – 3.00
AC XFMR – 1.50

Do not confuse with Non-Alarm kits sold by our competition! Eliminate the hassle – avoid the 5314!

SIX DIGIT ALARM CLOCK KIT

We made a fantastic kit even better. Redesigned to take advantage of the latest advances in I.C. clock technology. Features: Litronix Dual ½" displays, Mostek 50250 super clock chip, single I.C. segment driver, SCR digit drivers. Greatly simplified construction. More reliable and easier to build. Kit includes all necessary parts (except case). P.C.B. or XFMR optional.

NEW! WITH JUMBO LED READOUTS!

Motorola SCR

2N4443. 8 AMP 400 PIV. P.C. Leads 3/$1.

FAIRCHILD - TBA 641

4W. Audio power Amp. Just out! In special heat sink DIP. One super audio IC. $1.50 with data

FND-359 -Led Readout

.4 IN. Common Cathode. High effeciency. Has FND-70 PIN OUT. 59c

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- Dot memory.
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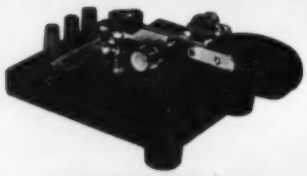
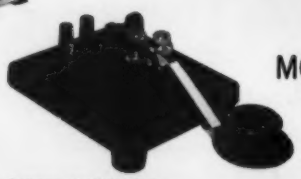


MODEL HK-1
$29.95



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- Paddles reversible for wide or close finger spacing.

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1N914	100v	10mA	.05
1N4004	400v	1A	.08
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	1.25
24-pin	pcb	.35	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

Molex pins	.01	To-3 Sockets	.25
2 Amp Bridge		100-prv	1.20
25 Amp Bridge		200-prv	1.95

TRANSISTORS, LEDS, etc.

2N2222	NPN			.15
2N2907	PNP			.15
2N3740	PNP	1A	60v	.25
2N3906	PNP			.10
2N3054	NPN			.35
2N3055	NPN	15A	60v	.50
T1P125	PNP	Darlington		.35
LED Green, Red, Clear				.15
D.L.747	7 seg 5/8" high com-anode			1.95
XAN72	7 seg com-anode			1.50
FND 359	Red 7 seg com-cathode			1.25
HP276	com-cathode			1.25

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4000	.15
4001	.20
4002	.20
4004	3.95
4006	1.20
4007	.35
4008	1.20
4009	.30
4010	.45
4011	.20
4012	.20
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	.95
4023	.25
4024	.75
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.35
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.60
4066	1.35
4069	.40
4071	.35
4082	.45

— T T L —

7400	.15
7401	.15
7402	.20
7403	.20
7404	.15
7405	.25
7406	.35
7407	.55
7408	.25
7409	.15
7410	.10
7411	.25
7412	.30
7413	.45
7414	1.10
7416	.25
7417	.40
7420	.15
7426	.30
7427	.45
7430	.15
7432	.30
7437	.35
7438	.35
7440	.25
7441	1.15
7442	.55
7443	.85
7444	.45
7445	.80
7446	.95
7447	.95
7448	.95
7450	.25
7451	.25
7453	.20
7454	.25
7460	.40
7470	.45
7472	.45

7473	.25
7474	.35
7475	.35
7476	.30
7480	.55
7481	.75
7483	.95
7485	.95
7486	.30
7489	1.35
7490	.55
7491	.95
7492	.95
7493	.40
7494	1.25
7495	.60
7496	.80
74100	1.85
74107	.35
74121	.35
74122	.55
74123	.55
74125	.45
74126	.35
74132	1.35
74141	1.00
74150	1.00
74151	.75
74153	.95
74154	.75
74156	1.15
74157	.65
74161	.85
74163	.95
74164	.60
74165	1.50
74166	1.35
74175	.80

74176	1.25
74180	.85
74181	2.75
74182	.95
74190	1.75
74191	.35
74192	1.65
74193	.85
74194	1.25
74195	.95
74196	1.25
74197	1.25
74198	2.35
74221	1.00
74367	.85
75108A	.35
75110	.35
75491	.50
75492	.50
74H00	.25
74H01	.25
74H04	.25
74H05	.25
74H08	.35
74H10	.35
74H11	.25
74H15	.30
74H20	.30
74H21	.25
74H22	.40
74H30	.25
74H40	.25
74H50	.25
74H51	.25
74H52	.15
74H53J	.25
74H55	.25

74H72	.55
74H101	.75
74H103	.75
74H106	.95
74L00	.35
74L02	.35
74L03	.30
74L04	.35
74L10	.35
74L20	.35
74L30	.45
74L47	1.95
74L51	.45
74L55	.65
74L72	.45
74L73	.40
74L74	.45
74L75	.55
74L93	.55
74L123	.55
74S00	.55
74S02	.55
74S03	.40
74S04	.35
74S05	.35
74S08	.35
74S10	.35
74S11	.35
74S20	.35
74S40	.25
74S50	.25
74S51	.45
74S64	.25
74S74	.40
74S112	.90
74S114	1.30

74S133	.45
74S140	.75
74S151	.35
74S153	.35
74S157	.80
74S158	.35
74S194	1.05
74S257(8123)	.25
74LS00	.45
74LS01	.45
74LS02	.45
74LS04	.45
74LS05	.55
74LS08	.45
74LS09	.45
74LS10	.45
74LS11	.45
74LS20	.40
74LS21	.25
74LS22	.25
74LS32	.40
74LS37	.40
74LS40	.55
74LS42	1.75
74LS51	.65
74LS74	.75
74LS86	.75
74LS90	1.30
74LS93	1.00
74LS107	.95
74LS123	1.00
74LS151	.75
74LS153	1.20
74LS157	.85
74LS164	1.90
74LS367	.85
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9309	.35
9322	.85
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LM310	1.15
LM311D(Mini)	.75
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LM320K5	1.65
LM320K12	1.65
LM320T12	1.25
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LM339	.95
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LM340T-12	1.00
LM340T-15	1.00
LM340T-18	1.00

LM340T-24	.95
LM340K-12	2.15
LM340K-15	1.25
LM340K-18	1.25
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LM747	1.10
LM1307	1.25
LM1458	.95
LM3900	.50
LM75451	.65
NE555	.50
NE556	.95
NE565	.95
NE566	1.75
NE567	1.35
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KIT #163 MINI TRIM POTS — 30 for 1 oz. $1.98. Assrt. values 100 to 1 meg. What a buy. Single turn. ¼ W, Wt. 6 oz. SA3343

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KIT #159 MODULAR SWITCHES — 25 for $1.98. Centralab switches, TV-makers access. Dpdt, 6pdt, etc. Brand new. Cat. No. SA 3160

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KIT #143 MINI TRANSFORMS — 15 for $1.98. outputs, interstage and audio. Only 1" sq. Wt. 2 lbs. SA3294

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KIT #127 AXIAL ELECTROS — 40 for $1.98. Asst. capacities and voltages. Cat. No. SA 3227

KIT #126 UPRIGHT ELECTROS — 40 for $1.98. 1mf to 300mf in mixtures of voltages. 100% marked 'n good. SA3226

KIT #115 MOLEX SOCKETS — 100% good 200 for $1.98. Cat.No. SA 3146. Calculator maker dump! We got a million of 'em.

KIT #113 MICRO MINI LEDS — 40 for $1.98. All the tiny leds, axial, upright of Monsanto, Litronix, variety of colors. Yield 50% or better. SA 3120

KIT #108 TERMINAL STRIPS — 100 for $1.98. Wide asst. of terminal strip connectors, from 1 contact up. Strip manufacturers barrel dump in your gain. Wt. 1 lb. Cat.No. SA 3136

KIT #108 TO-5 PLASTIC TRANSISTORS — Cat.No. SA 3101. 40 for $1.98. Includes PNP, NPN, 2N-3638, 2N3641, 2N5000 series, etc. Untested.

KIT #104 SLIDE VOLUME CONTROLS — 10 for $1.98. Cat.No. SA 3037

KIT #101 RESISTOR SPECIAL — 200 for $1.98. Includes: ⅛, ¼, ½, 1, 2-wattors, carbon, 5 oz. 100% good. SA 3054

KIT #99 PHOTO ELECTRIC CELLS — 10 for $1.98. Asst. GE types, CDS types. Mixed by factory. Big job for us to separate. 100% good. Cat.No. SA 3052

KIT #83 HALF WATTERS — 200 for $1.98. Resistor factory tried to fool us by mixing 100% color-coded resistors in barrel. But value is there. 4 oz. SA 3046 Untested

KIT #92 3 AMP EPOXY RECTIFIERS — Untested 100 for $1.98. Cosmetic rejects, electrically fine business! You check 'em, it's not for us. Asst. voltages. SA 3104

KIT #81 SILVER MICAS — 100 for $1.98. Axial, red case, variety of physical sizes & values. Cat.No. SA 3019

KIT #86 DIGITS LED READOUTS — 10 for $1.98. 747's, 727's, singles, triples, etc. .33 to 0.6. Rot from factory, all mixed; have fun! No. SA 2981

KIT #87 NATIONAL IC BONANZA — 100 for $1.98. Types 8000, 7400 series, DTL, ROMs, registers, clock & calc. chips, linears, etc. Cat.No. SA 2899 Untested.

KIT #86 HOBBY LEDS — 40 for $1.98 Untested. 747's, 727's, singles, triples, etc. .33 to 0.6. Rot from factory, all mixed; have fun? SA 2895

KIT #83 — 15 for $1.98. LM-340T VOLT REG. Factory rejected them for tenths of leads. May include 5, 6, 8, 12, 15, 18, 24 volts. Power tab Cat. SA 2635

KIT #81 SUBMINI RESISTORS — 200 for $1.98. PC, upright type, color coded, ½ watt. Asst values. Came to us in a barrel. Cat.No. SA 2746 100% good

KIT #76 1-WATT ZENERS — 100 for $1.98. Factory same as 400-mw's. Never-to-see-again offer. 5, 8, 10, 12, 15V, under glass. Double plug. Cat.No. SA 2741 Untested.

KIT #72 TRANSISTOR ELECTROS — 50 for $1.98. We don't wish to separate wide asst voltages & values up to 500 mf. Cat. SA 2747

KIT #71 CAPACITOR SPECIAL — 100 pcs. $1.98. micas, moldeds, plastics, ceramics, discs, etc. Nifty 100 pc good Cat.No SA 2730

KIT #68 2 WATTERS — 100 for $1.98 100% good. Suppliers throw 'em in the barrel. It's a B'l gold mine. All marked. Cat.No. SA 1735

KIT #65 MIXED READOUTS — 10 for $1.98. Factory returns — 'such numbers as MAN-4's, MAN-7's, MAN-3's, 11 barrels & no time to separate. Cat.No. SA 2733 Untested.

KIT #61 POLYSTYRENE CAPS — 100 for $1.98. Finest caps made. As a gamble we bought 10 barrels from factory, mixed values; all good. Cat.No. SA 2729

KIT #58 SLIDE SWITCHES — 30 for $1.98. All shapes, sizes, spst, dpdt, momentaries, etc. Tremendous shop pak for 100's of switching projects. Cat.No. SA 2726 100% good

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KIT #54 9 DIGIT READOUTS — 10 for $1.98. Bargain of a lifetime! All we got was 1 barrel — the "blister digit" types. Multiplexed. Cat. No. SA 2732

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KIT #27 PREFORMED DISCS — 150 for $1.98. Hi-K mfr's shelf inventory but he dumped 'em in barrels. Preformed, for PC use Mixed values too! SA 2603

KIT #26 PLASTIC TRANSISTORS — 100 for $1.98 Untested. Type TO-92 (TO-18), all manufacturers, variety of 2N #'s. Cat.No SA 2606

KIT #25 METAL CAN TRANSISTORS — 100 for $1.98. Includes TO-5, TO-1, TO-18, etc., assorted 2N numbers, unmarked etc. Cat.No SA 2603 Untested.

KIT #24 LONG LEAD DISCS — 100 for $1.98. "auction sale" Prime, marked only. Long leads Cat.No SA 2598 150% good

KIT #19 DIPPED MYLARS — 60 for $1.98. Finest capacitors made, shiny finish. Imagine factory dumping 'em in barrels. Cat.No. SA 2527 100% good

KIT #17 LINEAR & 7400 DIPS — 100 for $1.98 Untested. Marked and unmarked, internal numbers of raw factory stock. Cat.No SA 2431

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KIT #10 ROMS-REGISTERS — 75 for $1.98 Untested. 2's to 40 pin devices, marked, at internal factory numbers, etc Cat.No. SA 2424

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Social Events

from page 161

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AKRON OH
JUNE 12

The Goodyear Amateur Radio Club of Akron, Ohio will hold its 10th Annual Hamfest and Family Picnic on June 12, 1977 at Wingfoot Lake Park between the hours of 10 am and 6 pm. The park is located southeast of Akron on County Road 87 near Route 43. Ample parking, rain shelters, picnic facilities, kids' play areas and refreshment stands. The flea market/swap shop space is free with the admission ticket. Gear displays, prizes, etc. Sorry – no overnight parking or swimming. Mobile check-in on 04/64. Family donation $2 advance, $2.50 at gate. For more info contact Don Rogers WA8SXJ, 161 S. Hawkins Ave., Akron, Ohio 44313. Phone: (216) 864-3665.

SANTA MARIA CA
JUNE 19

The Satellite Amateur Radio Club is sponsoring its annual Santa Maria Amateur Radio Picnic and Swapfest Sunday, June 19, 1977 beginning at noon, at the Newlove-Union Oil Picnic Grounds on Orcutt Hill (watch for the sign marking the turn-off one mile south of Clark Ave. on U.S. 101). Swap tables available at $3 each. Santa Maria Style Barbecue to be served at 2:30 pm. Talk-in on 146.52 and 7280 kHz. Many prizes. Tickets $5.00 adults, $2.50 children. For advance orders, send checks to Santa Maria Swapfest, Post Office Box 1031, Nipomo, California 93444. For further info contact Satellite Amateur Radio Club, PO Box 1615, Vandenberg Air Force Base, CA 93437.

PORTAGE IN
JUNE 19

The Lake County Amateur Radio Club's 3rd annual hamfest is June 19th at the Isaac Walton League in Portage, Indiana. (Take I-94 to Ind. 249 exit, then north on Ind. 249 ½ mile.) Tickets: $1.50 advance, $2.00 at gate. Write: Herbert S. Brier W9AD (W9EGQ), 409 S. 14th St., Chesterton IN 46304.

JACKSONVILLE IL
JUNE 26

There will be a hamfest held in Jacksonville, Illinois June 26, 1977. Same place as last year. Talk-in 146.40/147.00 WR9ACS. For further information contact (after April 1st) Box 271, Jacksonville, IL 62651.

CUMMINGTON MA
JULY 9-10

The Northern Berkshire Amateur Radio Club Hamfest will be held July 9th and 10th at the Cummington Fairgrounds, Cummington MA. Free overnight camping, tech talks, demos., and dealers. Flea market $1. Admission $3 with XYL $5, advanced $2 and $4. For information write Hildy Sheerin WA1ZNE, 79 Greylock Ter., Pittsfield MA 01201.

OAK CREEK WI
JULY 9

The South Milwaukee Amateur Radio Club Swapfest '77 will be held Saturday, July 9, 1977 at Shepard Park (American Legion Post #434), 9327 South Shepard Avenue, Oak Creek, Wisconsin. Activities begin at 7 am and will run until about 5 pm.

Are YOU a computer hobbyist — yet?

If you are like the rest of us you've been reading about microcomputers . . . you're excited about them . . . but there is so much to understand and it all seems so complicated that there is no way to understand it.

Hogwash.

A brand new magazine is being published for computer hobbyists . . . for people who are beginners . . . neophytes . . . novices . . . people who have no idea what a vectored interrupt is, but just the same want to learn about computers and have fun.

A home computer system can cost you a bundle if you don't know what you are doing. Kilobaud could save you a lot of money . . . others have learned the hard way. Kilobaud is a sort of giant club newsletter for computer hobbyists . . . a place to tell each other about the problems they've had . . . and the solutions. It's a magazine filled with great articles . . . all written so you'll be able to understand them (for a change).

You want to know about hardware? Read about the new MITS Z-80 CPU in Kilobaud, simply explained by the chap who designed the circuit. Or how about the best-selling TDL Z-80 CPU . . . the designer has written about it in Kilobaud too. You're wondering about what cassette system to use? You can go crazy on this one . . . but before flipping out, read the Hal Walker article in Kilobaud and find out what the problems are . . . and the solutions.

What do you do with the confounded things after you've gotten them working? The programs are in Kilobaud . . . lot's of them.

MAKE MONEY

Perhaps you've been thinking of the computer hobby as a way to get into a small business. Why not? This is going to be an enormous field in a couple of years and you can bet that those on the ground floor will have the best chance at the gold ring. Kilobaud will help you learn how to get into manufacturing . . . to become a dealer . . . a manufacturer's representative . . . a service bureau . . . a writer. Never before has there been an opportunity like this . . . so don't muff it . . . grab hold and start getting your feet wet. It'll not only pay off well in the long run, you'll have a ball every minute of the way.

KILOBAUD IS BRAND NEW

The first issue was January 1977 . . . and the magazine is the fastest growing and best accepted magazine in the hobby computer field already. You doubt that? Just stop in at any hobby computer store and ask anyone you see. Kilobaud is outselling all other magazines combined . . . which says something considering the cover price of $2. It's full of good articles and has a sense of humor. There are more articles in Kilobaud than you can read in a day . . . most readers comment that Kilobaud just has to be read from cover to cover and this takes several days. It's packed.

CONTROVERSIAL?

You bet! Kilobaud calls a spade a spade, with no pulled punches.

DO YOU WANT TO LEARN COMPUTERS?

Some magazines emphasize OEM systems . . . some are written more for computer scientists . . . Kilobaud is written for and by its readers . . . the hobbyists. You'll find great articles in there by well known hobbyists such as Don Lancaster . . . Don Alexander . . . Pete Stark . . . Dennis Brown . . . Hal Walker . . . Art Childs . . . Sheila Clark . . . and many more. The emphasis is fun.

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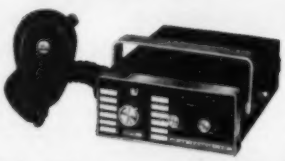

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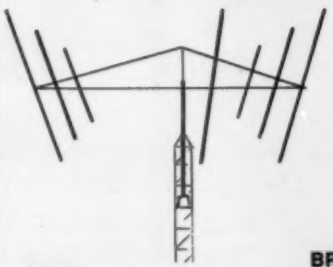

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B13

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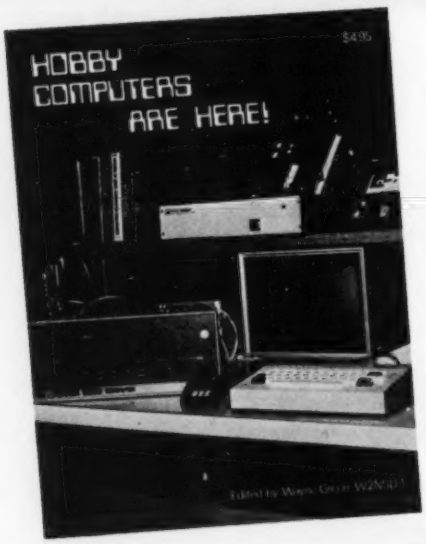

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JUNE 63. Surplus issue: DMO-2 Beacon Tx on 220, increasing ARC-2 transceiver selectivity, PE-97A pwr supply conversion, BC-348 band-spread, inductance tester, converting BC-230 tx, beginner's rx using BC-453, rcvr motor-tuning, transistor cw monitor, BC-442 ant relay conversion, mobile loading coils, increasing Two-er selectivity, TV with the ART-26 tx, TRC-8 rx on 220, ARC-5 hf rx & tx, ARC-3 tx on 2M.

AUG 63. Battery-op 6M stn, diode noise gen, video modulation, magic T-R switch, ant gain, halo mods, cw breakin, VEE beam design, coax losses, RF wattmeter, TX Tube Guide, diode pwr supply, "Lunchbox" squelch, SWR explanation, vertical ant info, info on Windom ant.

OCT 63. WBFM transceiver ideas, HF propagation, cheap tone patch, remote-tuned Yagi, construction hints, ant coupler, 6B Vertical, filament xformer construction, 2M nuvistor converter, Lafayette HE-35 mods, Buyer's Guide to Rx & Tx, product detector, novel Hi-C VFO, radio astronomy, panadaptor "if" converter, compact mike amp.

FEB 64. 2M multichannel exciter, rx design ideas, magic t/r switch, loudspeaker enclosures, 40M 2W tx, look at ssn, ant coupler, radio grounds, 40M ZL Special ant, neutralization.

MAY 67. Quad Issue: 432 Quad-quad-quad, expanded HF quad, Two el quad, miniquad, 40M quad, quad experiments, half-quad, three el quad, 20M quad, tiltover quad, easy-to-erect quad, Quad Bibliography, FET vfo, tube troubleshooting, HF dummy load, understanding "dB," HF SSB/cw rx, geometric circuit design, GSB-201 transceive, FET converter for 10-20M, hi-pass rx filters.

JULY 67. VE ham radio, VE8 hams, dsb adaptor, home brew tower, transistor design, '39 World's Fair, gnd plane ant, G4ZU beam, SSTV monitor, UHF FET preamps, IC "if" strip, vertical ant, VHF/UHF dipper, tower hints, scope monitoring, operating desk, S-Line crossband, hi-school ham club, Heath HR-10 mods.

OCT 67. HF solid state rx, rugged rotator, designing slug-tuned coils, FET converter, SSTV pix gen, VHF log-periodics, rotatable dipole, gamma-match cap, old-time dxing, modern dxing.

JUNE 68. Surplus Issue: Transformer tricks, BC-1206 rx, APS-13 ATV tx, low voltage dc supply, surplus scopes, FM rig commercial xtal types, Wilcox F-3 rx, repairing old speech ckt, 75A1 rx mods, TRA-19 on 432, freq counter uses, transceiver pwr supply, uses for cheap tape recorders, Surplus Conversion Bibliography, RT-208 walkie on 2M, ARC-1 guard rx, RTTY tx TU.

JULY 68. Wooden tower construction, tiltover towers, erecting a telephone pole, IC AF osc, "dB" explained, ham club tips (Part 1).

SEPT 68. Mobile vhf, 432 FET preamps, converting TV Tuners, xtal osc stability, parallel-Tee design, moonbounce rhombic, 6M xciter (corrections Jan 69), 6M transceiver (corrections Jan 69), 2M dsb amp, ham club tips (Part 3).

NOV 68. SSB xtal filters, solid state trouble shooting, IC freq counter (many errors & omissions), "cv" transformers, space comm odyssey, pulser info, thin-wire ants, 40M transistor cw tx/rx, BC-348M double conversion, multifunction tester, copper wire specs, thermistor applications, hi-voltage transistor list, ham club tips (Part 5).

JAN 69. Suppressor compressor, HW-12 on 160, beam tuning, AC voltage control, 2M transistor tx, LC power reducer, spectrum analysis info, 6M transistor rx, operating console, RTTY autostart, calculating osc stability, lo-pwr 40 cw tx, sequential relay switching, sightless operator's bridge, ham club tips (Part 7).

FEB 69. SSTV camera mod for fast-scan, tri-band linear, selective af filter, unijunction transistor info, Nikola Tesla biography, mobile installation hints, extra-class license study (Part 1).

MAR 69. Surplus issue: TCS tx mods, cheap compressor/amp, RXZ calculations, transistor keyer, better balanced modulator, transistor oscillators, using blowers, halfwave feedline info, Surplus Conversion Bibliography, extra license study (Part 2).

APR 69. 2-channel scope amp, rx preamp, Two-er PTT, variable DC load, SWR bridge, 100 kHz marker gens, some transistor specs, SB-610 monitorscope mods, portable 6M AM tx, 2M converter, extra license study (Part 3).

MAY 69. 2M Turnstile, 2M Slot, rx attenuator, generator filter, short VEE, quad tuning, using antennascope, measuring ant gain, phone patch regs, SWR indicator, 160M short verticals, 15M antenna, HF propagation angles, FSK exciter, KW summy load, hi-power linear, extra license study (part 4), all-band curtain array.

JUNE 69. Microwave pwr generation, 6M sb tx, 432-er tx/rx, 6M converter, 2M 5/8 wave whip, UHF tv tuners, ATV video modulator, UHF FET preamps, RTTY monitorscope, extra license study (part 5), building uhf cavities, mini-VEE for 10-20M, vhf vfo.

JULY 69. AM modulator, SSTV sig gen, 6M kw linear, 432 KW amp, 432-er tx/rx, 6M IC converter, radio-controlled models, RTTY IC TU, audio notch filter, VRC-19 conversion, tube substitution, 2M transistor xciter, extra license study (part 6), hf FET vfo.

AUG 69. FET regen for 3.5 MHz up, FM crystal switching, 5/8 wave vertical, introduction to ICs, RTTY tone gen, good/bad transistor checker, 2M AM tx, measure transistor Ft, 160M propagation, triac applications, simple IF sweep gen, transistor keyer, SB-100 on 6M, xtal freq measurement, extra license study (part 7), FM deviation meter, qrp am 6M tx, circular quads, FM noise figure, transistor parameter tracer.

SEPT 69. Tunnel diode theory, majic tee, soldering techniques, wave travel theory, cable shielding, transistor theory, AM noise limiter, APSK gen, transistor amp debugging, measure meter resistance, diode-stack pwr supply, transistor testing, 2½W 6M tx, HX-10 neutralizing, capacitor useage, radio propagation, AM mod percentage, extra class license study (part 8), 3-400Z linear, ATV vidicon camera, 2 transistor testers, FET compressor, rf plate choke.

OCT 69. Super gain 40M ant, FET chirper, telephone info, scope calibrator, thyrector surge protector, slower tuning rates, identify calibrator harmonics, PM adaptor for AM tx, CB sets on 6M, proportional control xtal oven, xtal filter installation, Q-multiplier, transceiver pwr supply, extra class study (part 9).

NOV 69. NCX-3 on 6M, IF notch filters, dial calibration, HW32A external VFO, 6M converter, feedline info, rf z-bridge, fm mobile hints, umbrella ant, 432-er tx (part 1), pwr supply tricks with diodes, transistor keyer, transistor design, xtal vhf sign gen, electronic variac, SB33 mods, extra class study (part 10), SB34 linear improvements.

DEC 69. Transistor-diode checker, dummy load/attenuator, tuned filter chokes, band-switching Swan 250 & TV-2, 88mh wattmeters, match exercizes, rtl xtal calibrator, transistor pa design, hv mobile p.s., 1-10 gHz frequmeter, CB rig on 6M, extra license study (part 11), 1970 buyer's guide.

JAN 70. Transceiver accessory unit, bench power supply, SSTV color method, base-tuned center-loaded ant, 6M bandpass filter, extra license study (part 12, rectifier diode useage, facsimile info.

FEB 70. 18-inch 15M dipole, 6M converter, high-density pc board, camper-mobile hints, 2M freq synthesizer, encoding/decoding for repeaters, DX-35 mods, panoramic vhf rx, variable-Z HF mobile mount, extra license study (part 13), linear IC info, qrp 40M tx, IC Q-multiplier.

MAR 70. Gdo applications, charger for drycells, FM freq meter, pc board construction, ham fm standards, cheap rf wattmeter, multifreq fm osc, "IF" system modules (part 1), Six-er mods, gdo dip litz, Motorola 41V conversion, cw monitor, buying surplus logic, SBQ-23A sonobuoy conversion, GRC-9 rx/tx conversion, extra class study (part 14), intro to vhf fm.

APR 70. Noise blanker, 2M hotcarrier diode converter, repeater controller, understanding COR repeater, 7/8-wave 2M ant, extra class study (part 15), inexpensive semiconductors, removating surplus meters, linear amp bias regulator, hi performance if amp & agc system, SSB bfo for shortwave radio, vacuum tube load box, general fm dope & repeater guide, megger-ing your ant.

MAY 70. Comments on "fm docket" #18803, future of cw, fm-am rx aligner, 5/8-wave verticals, using 2M intelligently, auto burglar alarms, pwr supplies from surplus components, "IF" system modules (part 2), vhf FET preamps, educated "idiot" lines, postage-stamp 6M tx, extra class study (part 16), Bishop IFNL, low-band police monitor, mobile cw tx, Wichita auto-patch.

JUNE 70. DORR ant, vfo circuit, remote SWR indicator, indoor hf vertical, two rx on one antenna, environment & coax loss, 2-el trap verticals, buying surplus, two 40M qrp tx, 21dB 2M beam, extra class study (part 17).

DEC 70. Solid-state vhf exciter, delta-fre control for SSB, 2M transistor FM tx, HW100 offset tuning, "little gate" dipper, 3-500Z hf linear, general class study (part 8), "transi-test" (no good – errors!), transistor p.s. current limiter.

JAN 71. Split fones for dxing, Heath Ten-er mods, cw duty cycle, repeater zero-beater, HEP IC projects, 10-15-20M parabolic ideas, lightning protection, IC rx accessory, attic ants, double-balanced mixers, permanent marker tool, ham license study questions.

FEB 71. Metal locator, varactor theory, AFSK unit, SSTV patch box, ATV hints, RTTY tuning indicator, tone encoder/decoder, 220 MHz converter, SSTV magnetic deflection, IC code osc, 6M tx peeper, general class study (part 6), RTTY intro, perf-board terminal, low-ohmmeter.

MAR 71. IC audio filter, IC 6M converter, trap vertical ideas, digi counter info, surplus equipment identification, hf linear, simple fone patch, repeater audio mixer, digi RTTY accessories, coathanger gndplane, general class study (part 7).

APR 71. Intro to fm, noise blanker, repeater problems, Motorola HT mods, microwave repeater linking, digital ID unit, tunesble 2M fm rx/tx, repeater marketplace, fm marketplace, meter evaluator, varactor modulator, simple sig gen, touchtone hookup, hf preselector, 10M 12W tx.

MAY 71. 75M mobile whip, 2M preamp, transistor amp design, 10M dsb tx, portable fm transceiver directory, audio compressor-clipper, transistor LM freqmeter, 450 MHz link tx, simple af filter, 1-tube 2M transceiver, surplus 2M power amp, general class study (part 8).

JUNE 71. 2M beam experiments, 3 el 2M quad, multi-band dipole patterns, weather balloon vertical, pocket-pager squelch, two-er vfo, tuning mobile whips, transistor pwr supply, capacity decade box, 40M gain ant, general class study (part 9).

JULY 71. IC audio processor, audio sig gen, cw filter, 2M fm osc, 2M collinear vertical, FM supplier directory, Motorola G-strip conversion, transistor beta tester, general class study (part 10).

AUG 71. Ham facsimile (part 1), 800 Watt linear, dimensions for July collinear, 4-tube 80/40 station, vfo digi readout, Jupiter on 15M, general class study (part 11), pink ticket wavemeter.

SEPT 71. Transformerless power supplies, solid state tv camera, IC substitution, two rf wattmeters, IC compressor-sgc, multichannel HT-200, ham facsimile (part 2), causes of manmade noise, vfo with tracking mixer, general class study (part 12), transistor heat-sinking, IC pulse gen, fone-patch isolation, hcd wattmeters.

OCT 71. Emergency repeater opr, transceiver power supply, predicting meteor showers, digi switching, reverse-current battery charger, passive repeaters, earth grounds, audio "tailoring" filters, Swan 350 mods.

NOV 71. 3-el 75M beam, motor-tuned gndplane, 2M gain vertical, transistor biasing, split-site repeater, fox-hunting, audio filter, transistor/diode tester, xtal tester, 6M kw amp, 10-15-20M quad, transistor pi-net final, ant feedline, communications dbe, 2300 MHz exciter.

AUG 72. SSTV intro, speech processor, fm repeater info, test probe construction, GE progline ac supply, 432 rf testing, preamp-compressor, Six-er mods, fone patch, Two-er info, solar info, SCR regulator for HVPS, "ideal" xtal osc, fm rx adaptor, auto theft alarm.

SEPT 72. Plumbicon tv camera, WWVB 60 kHz rx, cigartube sig gen, cw active filter, rf testing at 1296-3500 GHz, balun ant feed, transistor power supply, IC 6M rx, IC fm/am detector (part 2), active filter design (part 3), K2OAW freq counter (part 3), 2M freq synthesizer (part 1).

OCT 72. Corrections for Aug. fm rx adaptor, 2M freq synthesizer (part 2), 6M transistor vfo, nano-ampere meter, time-freq measurement (part 1), active filter design (part 4), repeater timer, extra-class Q&A (part 3), balloon vertical, ID gen, time delay relay, 432 filter ideas, DC-AC inverter, hc-diode converter, rtl decade and nixie driver, plus-minus supply for ICs.

NOV 72. Hf transistor power amps, RTTY selcal, IC trf rx, transistor keyer, emergency power, 220 MHz preamp, double-delta ant, simple converter using modules, hf RF tester, "lumped line" osc, 2M freq synthesizer (part 3), K2OAW counter errata, 2M preamp, extra class Q&A (part 4), hi-Z voltmeter, Nikola Tesla story, vhf swr meter, transistor regen rx, 432 SSB transverter, AC arc welder, intro to computers, hybrid am modulator, HR10 rx mods, 10M transistor am tx, 40M gndplane, IC logic demonstrator, overload protection, if/rf sweep generator, digi freq counter, aural tx tuning.

DEC 72. SSTV scope analyzer, 2M fm rx, tone burst encoder and decoder, universal if amp, autopatch hookup, LM380N info, voltage variable cap info, 2M 18 watt amp, SSB modulation monitor, xtal freq/activity meter, 10A var. dc supply, transmission line uses, radio astronomy, inductance meter, 75 to 20M transverter, LED info, 40M preamp, transistor vfo, 1972 index, 2M preamp.

JAN 73. HT-220 touchtone, 3-el 20M yagi, 50 MHz freq counter, speech processor, 2-tone gen, fm test set, tilt-over tower, 6M converter using modules, tuneable af filter, six band linear, 10M IF tuner, diode noise limiter, cw/ssb agc, HW22a transceiver 40M mod, HAL ID-1 mod.

FEB 73. CW id gen, tone operated relay, toroidal quadrature ant, active filter, time freq measurement (part 2), repeater timing control, SSTV circuits (part 1), 2M converter using modules, multifunction metering, FET biasing, freq counter preamp, TR22 hi-power mod, transistor rf power amps (part 1), light bulb rf power indicators, 75A4 filters, capacitance measurement, Gonset 201 mod, world time info.

APR 73. FM deviation meter, 2M FET preamp, two 2M power amps, repeater control (part 1), repeater licensing, European 2M fm, fm scanner adaptor, RCA CMU15 mods, lightning detector, cb alignment gadget, transistor rf power amps (part 2), repeater economics.

JUNE 73. 220 MHz sig gen, uhf power meter, repeater licensing info, RTTY autoswitch, 40M hybrid vfo tx, ant polar mount, 10-15-20M quad, K2OAW counter mods, double coax ant, ham summer job, tone decoder, field strength meter, nicad battery pack, ohm meter, FCC regs (part 1).

AUG 73. Log-periodics (part 1), tone burst gen, rf power amp design, transistor radio intercom, 160M ant, SSTV monitor, low cost freq counter, VOM design, qrp 40M tx, 432 MHz exciter, fm audio processing, FCC regs (part 3).

SEPT 73. Repeater control system, log-periodics (part 2), 2M rx calibrator, PLL ic applications, TT pad hookup, Heath HW7 "s" meter, Oscar-6 doppler, 2M coaxial ant, 2M converter, IC keyer, measure ant Z, FCC regs (part 4).

OCT 73. GE Pocketmate mods, microwave freq measurement, CA3102E 2M frontend, 2 kw hi linear, rf wattmeter, meter repair, 80/40 dipole, IC "hi" gen, vhf freq multiplier, FCC regs (part 5).

NOV 73. 450 MHz exciter, intro to ATV circuits, nicad voltage monitor, autopatch connections, IC meter amplifier, TR22 ac supply, indoor vertical, IC af filter, momentary power failure protection, 160M ant acoupler, Motorola HT info, SSTV-ISS, Class-B rf amp, FCC regs (part 6).

DEC 73. Code speed display, 2M kw amp, IC keyer, 8038 waveform gen, helical resonator design, sensitive rf voltmeter, proximity control switch, IC tester, sequential tone decoder, 2M portable beam, electronic calculator math, cw filter design, FCC regs (part 7).

FEB 74. SSTV monitor info, IC audio amps, scope sweep gen, 15/20M vertical, telephone line control system, pc board construction, var-Q af filter, blown-fuse indicator, 40m cw stn with Ten-Tec modules, simple preamp-compressor, single-IC rx, "432-er" final assembly, transistor keying circuit, 7-segment readout with nixie driver.

APR 74. Vox for repeaters, tone operated relay, hf transverter, 10-to-2m tx converter, remote control panel for scanner, RCA fm tx tuning, subaudible tone gen, FCC regs (part 9), Repeater Atlas.

MAY 74. Cd car ignition, audio compressor info, interference suppression for boats, auto burglar alarms, 2m ic preamp, 10m fet converter.

JULY 74. 4-1000A linear, universal freq gen, universal afsk gen, 555 IC timer, 80M phased array, 135 kHz-432 MHz preamps, 10M qrp am tx, 3000 vdc supply, how to read diagrams.

AUG 74. Toroidal directional wattmeters, 450 MHz FET preamp, use gdo to find "c", Trimline tt pad hookup, R390 & R392 rx mods, tracking cw filter, aural voltmeter, universal regulated supply, sstv scan converter, rtl logic problems, ID timer.

SEPT 74. MOSKEY electronic keyer (part 1), ex warning system, Heath 10-103 scope mods, qrp 6M am tx, rf speech clipper, audio noise limiter, wx satellite on SSTV monitor, universal IC tester, miniature rig construction, tower construction, infinite rf attenuator, electronic

(More)

photo-flash ideas, IC "select-o-ject."

OCT 74. Microtransistor circuits, synthesized HT-220 (part 1), repeater government, regulated 5 vdc supply, fm selcal, removeable mobile ants, Motorola metering, 2M vertical collinear, Motorola model code, 2M coaxial dipole, 1.6 MHz if strip, MOSKEY electronic keyer (part 2), carbon mike circuit, hi-power lo-pass filter, 6M preamp, 3-wire dipole, ATV sync gen, NCX-5 mods, mobile whip for apartment dwellers, sstv auto vertical trig.

NOV 74. K2OAW counter update, regulated 5 vdc supply, wind direction indicator, synthesized HT-220 (part 2), 20M 3-el beam, autopatch pad hookups, double-stub ant match, novice class instruction, digi swr meter (part 1), 6M converter (1.6 MHz if), "C-bridge," MOSKEY electronic keyer (part 3), Aug. sstv scan converter errata, repeater off-freq indicator.

DEC 74. Care of nicads, wind speed/direction indicator, wx satellite video converter, electronic keyer, hints for novices, unknown meter scales, SSTV tape ideas, TTL logic probe, public service band converter, tuned-diode test receivers, digi swr meter (part 2), telephone pole beam support, rhombic antennas, 1974 index.

FEB 75. Heath HO-10 scope mod for SSTV, electronic keyer, digital satellite orbital timer, Oscar-7 operation, satellite orbital prediction, Heath SB-102 mods, comparing FM & AM, repeater engineering, Robot 80-A sstv camera mod, neutralizing Heath SB-110A, "Bounceless" IC switch, tape keyer for cw tx.

APR 75. $50 walky for 2M, 2M scanning synthesizer, 88 mH toroid info, 8-function repeater controller, nicad battery precautions, TR22C preamp, telephone attachment regs, Guide to 2M Hand-held Transceivers, 2M 7-el beam, basic telephone systems (part 1), 10 min ID timer, modified hf Hustler mobile ant for 2M, 15M quad modified for 20M, 2M collinear beam, R-11A surplus rx conversion, 5/16-wave 2M ant, Hallicrafters SX-111 rx mods, 160M cw tx.

AUG 75. 146/432 MHz Helical ants (part 2), 10 min ID timer, digi swr computer (part 1), debugging rf feedback, DVM buyer's guide, wx satellite monitor, cmos "accu-keyer," pc board method, sweep-tube final precautions, compact multiband dipoles, small digital clock, accessory vfo for hf transceiver, modern non-Morse codes, multi-function gen, 2M scanning synthesizer errata, KP-202 walky charger, 10M multi-element beam.

SEPT 75. Calculating freq counter, wx satellite FAX system (part 1), IC millivoltmeter, three-button TT decoder, troubleshooting sstv pix, 40M dx ants, 146/432 MHz helical ants (conclusion), digi swr computer (conclusion), read relay for cw bit-in, NE555 preset timer, power-failure alarm, portable qrp rig power unit, precision 10 vdc reference standard, 135 kHz if strip, telephone handsets with fm transceivers, Motorola T-44 tx mod for ATV, 0-60 MHz synthesizer (part 10, ham radio PR).

OCT 75. A deluxe TTY keyboard (part 1), Op Amps: a basic primer, an introduction to microprocessors, 2m Synthesizer (conclusion), Satellite Fax System (conclusion), regulated supplies (dispelling the mystery), Digital Logic made simple, FCC interview, a contest uP system, digital clock time bases, the operating desk, QRP 432, ham PR.

NOV-DEC 75. Blockbuster double issue! Flip-flops exposed, breakthrough in fast scan ATV, strobing displays is cool, the tuned lunch box (antenna tuner for HF transceivers), a deluxe TTY keyboard (part 2), the 127' rotating mast, less than $100 multi-purpose scope for your shack (part 1), predicting third order intermod, feedline primer, QRMing the Third Reich, why tubes haven't died, instant circuits – build your own IC test rig, the K2OAW synthesizer PROM-oted, a ham's intro to microprocessing, Ground Fault Interrupter (a keep alive circuit for yourself), a $1 strip chart recorder, an even simpler clock osc., the Fun City surplus scene, updating the Heath IB-1101 counter, 256 pages!

Since there's little to get stale in back issues of 73 (our magazine is not padded ... like others ... with reams of activity reports), you'll have a fantastic time reading them. Most of the articles are still exciting to read ... and old editorials are even more fun for most of the dire predictions by Green have now come to pass. Incentive licensing was every bit the debacle he predicted ... and more. You'll really get a kick out of the back issues.

BACK ISSUES

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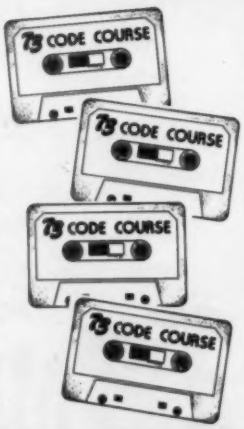

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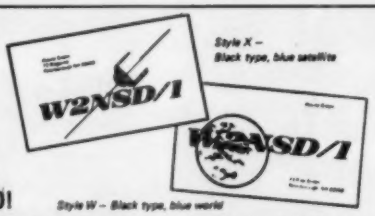

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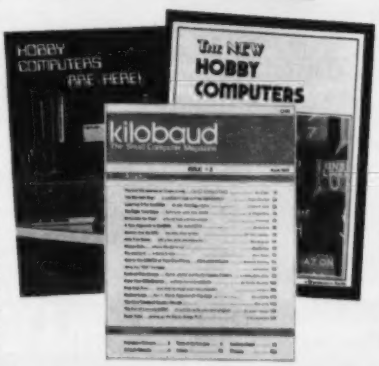

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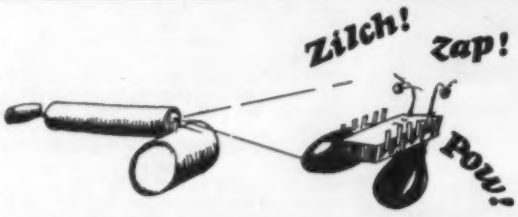

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A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Solar flares

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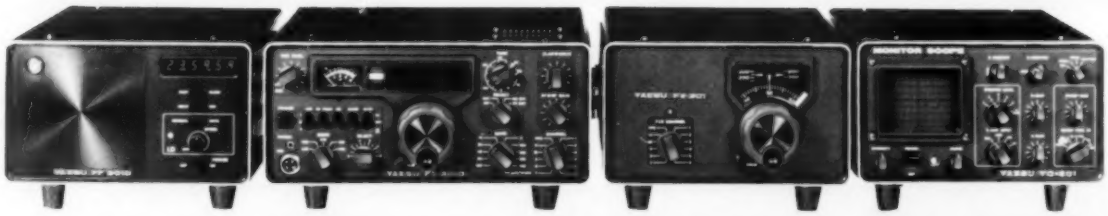

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